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DEVELOPMENT DIGEST

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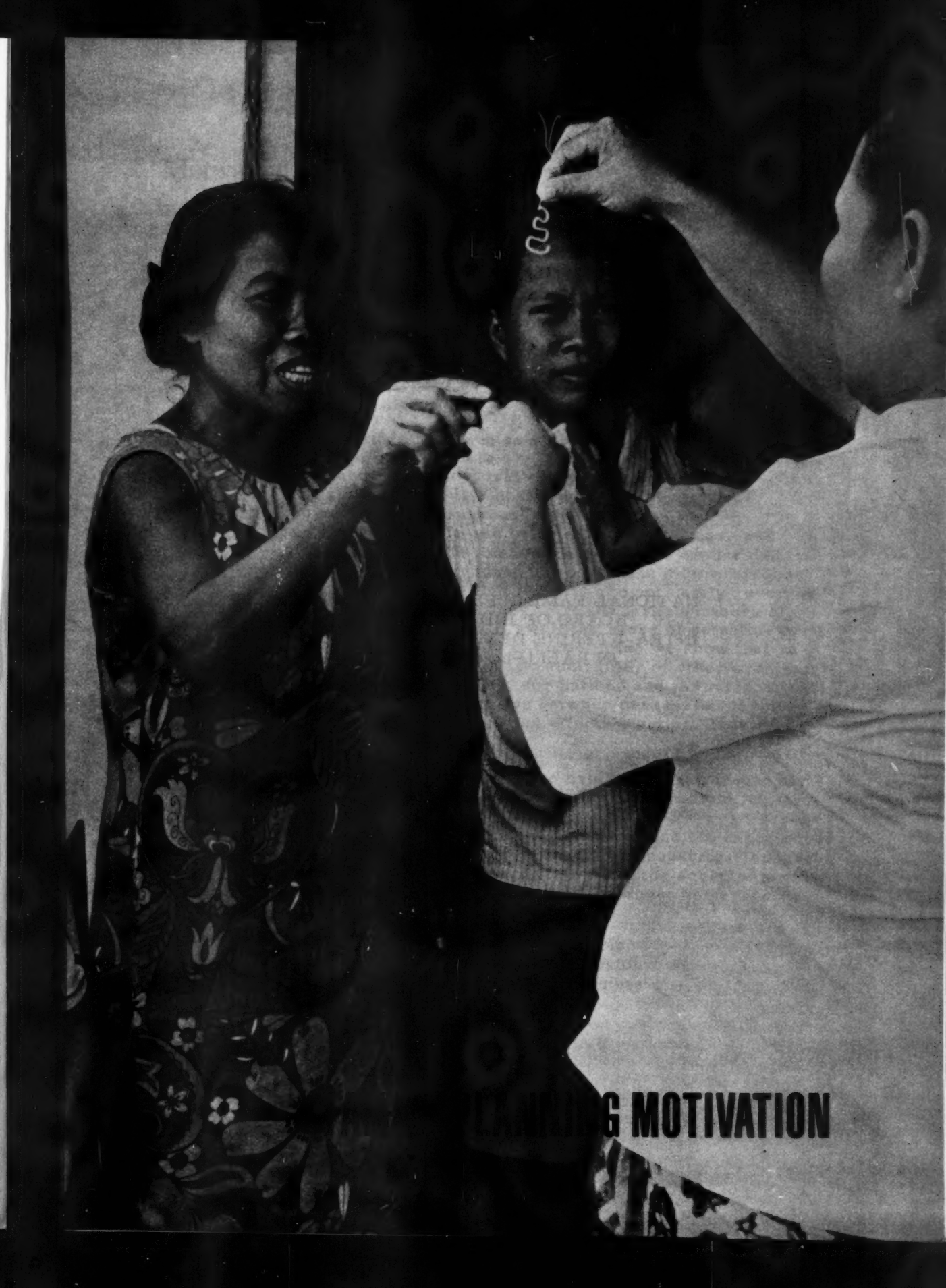

G MOTIVATION

MIDWIFE EMPLOYED BY
NATIONAL FAMILY PLANNING COORDINATING
BOARD OF INDONESIA EXPLAINS
INTRA-UTERINE DEVICE TO VILLAGE WOMEN
IN BALI (Photo: United Nations)

Motivation and Family Planning

Freya O. Bicknell and
Diana Chapman Walsh

[A key problem for family planning programs is the motivation of couples to accept the contraceptive services offered and to sustain the practice of family planning. Too often the manner of presentation of such services is flawed by cultural insensitivities and communication barriers which create unnecessary obstacles to acceptance, requiring high levels of motivation. New delivery systems such as community services could overcome many of these obstacles]

So much has been said about rapid population growth that the facts are losing much of their impact. We know that the world's population currently stands at about 4 billion, that it is growing at a rate of over two percent annually which means that 75-80 million people are being added every year, and that it will double in about 35 years. We know that rapid population growth has a built-in momentum because patterns of high fertility are not easily reversed, and because even if they were the large numbers of babies born today will swell the ranks of potential parents in the generation to come. And we know that rapid population growth is a multiplier of other problems – problems for families, for nations and the international community. But the gap between possession of this disquieting knowledge and effective action plans is wide and deep.

Those who are working to bridge this gap frequently pinpoint motivation as the core of the problem for family planning programs at their present stages of development. A review of the literature, and the experiences of the Pathfinder Fund in developing countries, suggest that a different approach to some of the accepted methods for instilling motivation might improve the prospects

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for family planning programs in the future. This different perspective would demand changes not on the part of the potential client so much as in the delivery system itself. Many programs have inadvertently incorporated unnecessary, often formidable bureaucratic, physical, economic and psychic disincentives in their structures. This paper will contend that delivery systems can and should be designed to reduce the amount of motivation currently required of potential new adopters.

Discussions of family planning information and education efforts commonly place them within a framework of stages in the development of programs. The stages proceed roughly as follows: Initially, a family planning group seeks to stimulate interest among the leadership of a country in population programs. When sufficient legitimacy has been won, clinical services are opened, usually first a few sites in an urban center under the aegis of a private family planning association, later in a government program administered through the existing health infrastructure. After a "clinic era" of several years' duration, the emphasis usually shifts to a field approach, characterized by more vigorous efforts to reach potential acceptors instead of waiting for them to take the initiative. Ultimately the existing demand for services appears to be met, and the number of new acceptors begins to reach a plateau and then may taper off. At this latter stage the challenge is to devise tactics and messages that will persuade as well as inform; the problem becomes motivational, and the primary onus rests with information campaigns.

How is this task of persuasion to be accomplished? To date, the predominant solution has been to deploy a cadre of "motivators" - paid or volunteer field workers engaged in face-to-face promotion of the concept and facts of family planning among individuals and groups. They are combined with at least some clinical services and often complemented by other communication strategies, including the mass media. It is not uncommon for field workers to constitute, in their salary and training costs, the largest single item in a national family planning budget. In the successful Asian programs in Korea, Taiwan, and Hong Kong field workers are credited with the direct or indirect motivation of the majority of acceptors.

Organizationally, motivator programs vary widely. In addition to trained social workers, the quasi-professional or lay motivators typically come from groups such as midwives, community leaders, housewives and satisfied users, teachers, merchants and traveling salespeople. Research evidence suggests that motivators are most effective when they are indigenous to the areas where they are working, that their effectiveness attenuates over both distance and time because they exhaust their sphere of personal contacts. Older field workers who are married, have children, and themselves have experience with contraception seem to be most successful. Their remuneration can take the form of a salary with or without bonuses, a per-acceptor incentive, or

can be nonexistent; strictly volunteer efforts, however, appear to do least well. Training ranges from about three weeks of intensive instruction in the highly organized programs to none whatever; and supervision, almost always a problem to some degree, also varies in extent and success. Home visits or group meetings can be stressed, or a combination of the two. On balance, home visits appear to be preferred.

There is little doubt that motivators can be quite effective in recruiting new adopters. A motivator can supply a form of personal communication on an intimate subject which the clinic cannot. A less obvious disadvantage of the motivator approach is an assumption underlying it: the belief that a shortage or lack of "motivation" among women in developing countries accounts fully for acceptance plateaus, and that this missing ingredient can and should be inculcated by outside agents. Sometimes there is confusion between motivation in the sense of a person's having a motive or desire, and "motivation" meaning the act of creating a motive in another person by persuasion. Too often the woman is assumed to be out there waiting with a desperate "need" for family planning if someone will only tell her about contraception, where it can be obtained, and possibly quell some slight fears or resistance. In fact, however, the woman's need is not necessarily a desire, nor is it absolute or unequivocal. If she already has some interest in spacing or limiting children, she may have some desire of indeterminate strength to get contraceptive assistance. But whether or not she will avail herself of an opportunity, and whether she will continue a method after her initial adoption decision, will depend on a number of factors both internal and external to the woman herself: the strength of her motivation (increased or perhaps made more explicit by the motivator) as against various factors of resistance, which might include cultural proscriptions against using contraception or frightening rumors about danger to her health, a distaste for interfering with the sex act, discomfort caused by the IUD when in place or problems remembering to take pills, and the disincentives which make it difficult to reach a clinic or difficult, unpleasant or costly to be served when there. An emphasis on "motivation" is misleading insofar as it oversimplifies this complicated interaction of individual feelings and reproductive decisions.

The task of persuasion is much more difficult where women have no desire for family limitation. It is generally acknowledged that high fertility in less developed countries derives from three basic perceptions: 1) that children have economic value because they share the burden of family labor, particularly in rural areas; 2) that they will serve as "social security" in their parents' old age; and 3) that they enhance their parents' prestige - a man's virility, a women's very raison d'etre. Often these perceptions are firmly rooted in reality. Under such conditions, effective fertility regulation is two long steps from realization: first, the basic desire to space, limit, or stop childbearing is needed; second, from that initial desire, the impetus is needed to seek out an effective

means of contraception and, with most methods, to use it continuously. The "motivator" is faced with a formidable task.

An alternative orientation is to reverse the perspective: instead of concentration on trying to increase the motivations of potential acceptors, we should ask whether there isn't some way to build from already existing motives by making the service more accessible, so that those who are only moderately interested will not be discouraged before they succeed in obtaining contraceptives. The lower the level of motivation needed, the more the potential acceptors. It has long been recognized that the more traditional methods (condoms, foam, the diaphragm, withdrawal, rhythm) require considerable and sustained personal motivation; the IUD and the pill, though not connected with the sex act also require commitment; and research is underway to find improved devices. But it is less common to look at delivery systems to see not only what they offer their potential clients, but what they ask in return. Existing programs frequently demand a higher level of personal motivation from clients than is either reasonable ornecessary.

Unnecessary obstacles to the practice of family planning result from cultural insensitivites and communication failures on the part of family planning programs. For example, family planning professionals have adopted language which often leads to misunderstanding, discomfort, and suspicion. Within the United States, Kanter and Zelnick interviewed a group of urban black women, found serious confusion about family planning terminology and concluded the "family planning, that nice middle class term --- doesn't convey the message that is intended." Epitomizing the verbal confusion they found, they cited a woman who spoke repeatedly of having her "coils tied." With evidence that American family planning language fails to communicate clearly among American audiences, it is hardly surprising that the export to developing countries of "modern family planning" - originated in Europe and North America and bearing Western, medically-rooted labels - often eventuates in ambiguity and perplexity.

The messages advanced by sponsors of family planning programs are often transplanted from one culture to another without being adequately pretested. For example, the appropriateness of the theme "responsible parenthood," widely adopted in Latin American countries, can be questioned on grounds that irresponsible parenthood implies an insult to those who do not participate in the family planning program. Messages encouraging couples to have the number of children they can afford take on cruel connotations in areas where many live life at the subsistence level, and can truly afford no children. Rogers points out that the association of oral contraceptives with curative medicine, based on the words used for them in most languages, unnecessarily complicates the way in which "the pill" is perceived (as a remedy for sickness) and contributes materially to high rates of discontinuance among pill users.

An inadequate appreciation on the part of program planners of the full limitations implied by illiteracy gives rise to additional subtle obstacles. Abstractions in general, as well as pictorial symbols and film making devices, can be misleading and distracting to an audience unaccustomed to them. The medium does become the message in this case, quite literally the entire message, obscuring totally its content. The message needs to be adequate and understandable but not excessively technical or detailed. Some of the most effective communication with illiterate and semi-illiterate audiences is done by analogy. Glaessel and Stycos describe the talk used in the Dominican Republic family planning program, where a simple dramatic gesture - closing the door and commenting that this is the way to keep the burglar out - replaces the confusing illustration of a diaphragm covering a cervix; where a birth control pill is dropped into a glass of water and shown to dissolve in order to counter the common fear that pills will accumulate in the body; or where an IUD is likened to a new pair of shoes, perhaps uncomfortable at first, but soon a part of oneself. Teaching methods such as these succeed because they translate the basic facts of family planning into the vernacular of ordinary experience. They are developed easily and naturally by people who are intimately familiar with the day-to-day lives of their audiences. But designers of family planning messages who are removed from the people they are trying to reach, and who operate at a high level of abstraction, run the risk of falling into the trap of pretesting a message for the field by showing it around the office.

Finally, and unfortunately, a catalogue of the obstacles needlessly barring access to family planning requires mention of the indignities and cruelty frequently visited on uneducated women by the purveyors of modern medicine. Mernissi's survey of sixty women in urban Morocco, for example, uncovered a pattern of humiliation affecting by association the family planning service situated in the hospital. One woman described vividly the eight hour wait:

> You have to wake up in the middle of the night. We start lining up at the gate of the hospital before dawn, around four o'clock. It is not that bad in the summer and spring, but when it is cold and rainy, it is not very pleasant. By eight, if you are lucky, you will get a ticket. Then you have to run home to wake up the child, feed him, dress him and run back to start a new line, this time inside the hospital courtyard. Sometimes you line up until 12:00 and you are told that you ought to come back another time.

The nurses are described as impatient and unsympathetic. They ridicule women who mispronounce medical terms and, in the words of another of the women interviewed, "you feel the floor crumble away under your feet." Women waiting for gynecological exams are required to undress before going into the doctor's office so as not to waste his time: "You take off your pants in the hall and sit there waiting. There are drafts of cold air, people walking by. You feel inhuman." In the

best of circumstances, most women dread visits to the gynecologist or his equivalent.

If some of the unnecessary and bureaucratic barriers to family planning can be removed, the result should be at least some reduction in the intensity of motivation required of new adopters. To reach those who are less highly motivated, a program must have a pleasant accessible service, appropriate language and, to the extent possible, contrceptive methods which are culturally compatible, and easily used. Several important modifications and expansions of the motivator approach described earlier hold some promise of fulfilling these requirements. For example, test demonstrations are completed or under way in a number of countries in Asia, Africa and Latin America using nurses, midwives, and auxiliaries to prescribe oral contraceptives and insert IUDs. Nonclinical or community-based distribution of oral contraceptives is being initiated in some of these countres. In such programs, the motivator also assumes the role of distributor or seller of contraceptive supplies and thus receives instant and direct feedback on the effectiveness of her sales pitch; prospective customers either purchase the supplies or they don't.

On example of the community distribution design is the Profamilia program in Colombia, described in the next article. A 1973 Ford Foundation-sponsored evaluation of this rural Profamilia program was highly favorable; and the first results of a current Pathfinder evaluation of the urban Profamilia program also look extremely encouraging. Instead of reliance on social workers representing a totally alien way of life, community women themselves are now doing the information and education work with their friends and neighbors. The women are enthusiastic and committed; the numbers of adopters have been impressive, and the cost per acceptor low. The Indonesian program described in a following article also illustrates the value of this general approach.

Community distribution programs, and the diversification they represent, look like the way of the future for family planning. It is clear that diversification is badly needed: an expansion and a broadening of thinking in program strategies, in communication channels used, in fertility control methods offered, in the range of organizations involved and government policies adopted. Community distribution seems to provide for that rare and salutary confluence of local resources and capabilities with real community needs that brings benefits to all: development for the community, personal growth for the contraceptive distributors and, for their friends and neighbors, a chance of improving the quality of life. This, after all, is what family planning is all about.

[Adapted from an adress to the Symposium on Family Health, Liverpool School of Tropical Medicine, April 1975.]

The Profamilia Rural Family Planning Program in Colombia

Gonzalo Echeverry, M. D.

[The Profamilia program in Colombia has been organizing family planning services at the community level in rural areas in conjunction with an existing developmental structure. Field workers train local leaders to advise on birth control matters and distribute contraceptives.]

Profamilia, a private family planning organization, has been providing services in the major urban areas of Colombia since 1966. Until 1970, however, Colombia's large rural population lacked access to family planning information and services at the local community level. This program is exceptional in working with an agricultural organization in its educational and motivational efforts, and in dispensing oral contraceptives through lay volunteers without direct medical supervision.

In 1970 Profamilia solicited the assistance of the National Federation of Coffee Growers in setting up a family planning program on an experimental basis in a few select rural areas in the state of Risaralda. Gradually services were extended to many other rural areas throughout the state and, after two years, to other states. By 1974, there were 370 rural distribution posts dispensing contraceptives in six states, and about 12,400 women had registered with the program.

The Experimental Program

Approximately 40 percent of the population of Colombia, or about 9 million persons, live in

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veredas, small, rural agricultural communities. They are relatively isolated, their only contact with life outside their vereda generally being a weekly visit to the market in the neighboring small town. The veredas have no public health services, and prior to the Profamilia Rural Family Planning Program few people had any access to family planning information or services. The average rural family is much larger than its urban counterpart. Sample surveys conducted prior to initiating the rural family planning program showed an average of seven children in the families interviewed, whereas the number of children the respondents said they wanted and considered ideal averaged 3.4.

On the basis of their investigations, it seemed clear to the directors of Profamilia that there was a need for family planning services in rural Colombia. Preliminary planning sessions were initiated in conjunction with the National Federation of Coffee Growers (FNC), which has an extensive network of rural extension agencies that assist coffee-growing communities in various ways. The rural extension personnel of FNC teach the people how to grow coffee and care for the plantations, educate them about nutrition and home economics, teach handicrafts, organize community activities, and organize social clubs for men, women, and youths.

There was no precedent for such a program in Latin America, and neither FNC nor Profamilia had any experience in this field They believed, however, that they had both the necessary organizational structure and sufficient knowledge of techniques to establish a pilot study in a small, clearly defined area. With the experience gained there, the project later could be extended to the rest of the country.

In November 1970 an experimental rural family planning program was set up in the Department of Risaralda, operated jointly by Profamilia and the Coffee Growers Committee of the Department. The experiment continued for two years before being extended to other areas. From it were developed the methods of communication, motivation, distribution, registration, and follow-up used in other Departments.

The Profamilia Rural Family Planning Program is based on the following principles:

1. Although contraceptive distribution posts have been set up in many small cabeceras (equivalent to a county seat) that lacked family planning services, the primary focus of the program is the vereda. Therefore, the program is essentially centrifugal, that is, it takes family planning information and services to the immediate community and into the home instead of requiring the people to come to a distant center or clinic to receive information and services.

2. The women responsible for communication and motivation (field workers) come from the same rural area and resemble as much as possible the people they serve. They speak the same language have the same customs and traditions, and can move through the community without being regarded as intruders or outsiders.

3. The family planning methods offered are those that can be dispensed without medical supervision, because medical personnel and facilities are very few in rural Colombia. For this reason, the program offers condoms and spermicides but not IUDs. It was decided, however, to also offer oral contraceptives. This decision, which runs counter to the thinking of some, was made because (a) excluding the IUD, the pill is the most effective means of birth control; (b) the medical risk it carries is smaller than the risks of pregnancy and childbirth; and (c) any woman experiencing side effects can always be referred to a physician at the nearest Profamilia clinic or health center.

4. Contraceptives are distributed in each participating vereda by a volunteer who is selected from among the natural "leaders" in the community. Because they are known and respected, the distributors are better able than outsiders to elicit the cooperation of the community. In addition, because distributors reside in the immediate area, participants in the program do not have to wait for the field worker's next visit to purchase contraceptives.

5. The existing FNC infrastructure in the vereda is used by the program so that parallel structures do not have to be created and efforts duplicated. The personnel and educational programs of the agricultural extension agencies are used to promote the idea of family planning. Because the people place great trust in these agencies, their influence is important to the success of the program.

6. Systems of registration, record-keeping, and administration comply with technical standards and conventions. At the same time, they have been simplified as much as possible so that they can be correctly carried out by the field workers and by the community volunteers. Record-keeping procedures must allow automatic and permanent evaluation of those who join the program, the length of time a method of contraception is used, the number of people transferring from one area to another, and the total number of cases lost to the program.

7. The basis of the program is education, and its success rests on the thoroughness with which the people are convinced of the benefits of family planning and understand the different methods. Only then will acceptors be motivated to continue to practice family planning on their own.

8. The family planning program is part of a wider plan of assistance, which is called "integrated rural development," and is not regarded as an end in itself.

Organizational Structure of the Program

The program is organized around three geographical units. In ascending order, they are the vereda, the county, and the work zone. The number of veredas in a county varies greatly - some have fewer than 25 and others have more than 85. A work zone consists of up to ten contiguous counties. There are four levels of personnel within the program. Each vereda in which the program operates has one distributor. Each field worker is in charge of ten veredas. For every five field workers, there is a field supervisor; and for every ten field workers and two field supervisors, there is a zone director.

Selection and Training of Field Workers. In terms of personnel, the basic unit is the female field worker, who is a full-time employee of Profamilia. She must meet the following requirements: have lived in the municipality in which she is going to work for at least five years; be at least 20 years old; preferably be married; and have at least two years of secondary education.

When a zone is being organized, at least two suitable candidates for the position of field worker are chosen from each county in the zone. They attend a one-week course in which they are introduced to the basic aspects of the program. Each candidate is given a small grant to cover her expenses. At the end of the course, the final selections (one field worker for every ten veredas) are made on the basis of a personal evaluation. The rest of the participants are considered substitutes and are called upon in the future if needed. Whenever possible, more than two candidates are trained from each county, not only to keep a number of trained people in reserve but because it has been seen that those who have received the training tend to voluntarily motivate women in their own communities to practice family planning.

Selected candidates then go on to a second phase of training in the field. They are divided into groups and, under a supervisor's direction, they hold community meetings within the veredas in the work zone. This phase lasts at least two weeks, with daily meetings for self-evaluation of the trainees. At the end of this phase each field worker begins work in her assigned area under the direction of a supervisor. Every two weeks, the field workers under each supervisor meet to evaluate their work and resolve any problems that have arisen. After a month, all the field workers and their supervisors

meet with the zone director for lectures and to discuss the program and its results. Various administrative matters are also discussed, such as salaries, monthly reports, the supply of materials and necessary forms, and so on.

For every ten field workers in a work zone there is a zone director, who may be male or female. Each director is provided with a vehicle and regularly visits the villages in the county to supervise the field workers, suggest possible improvements in their work, and help them resolve any difficulties. The zone director also collects data and records in the area for which he or she is responsible.

Operation of the Program

Once a county has been chosen for the introduction of the program, the field worker's first task is to contact the rural extension personnel of the local Coffee Growers Committee and gather as much information as possible about the veredas in the county, community leaders, and the existence of housewives' and "friendship" groups, young farmers' associations, and any other social or cultural clubs. The field worker is then in a position to carry out an investigation on a sample of the population to determine their knowledge of and attitude toward family planning. This is not a conventional KAP study but an interview with a simple questionnaire. The inquiry collects information on age, education, desired number of children, knowledge of contraceptive methods, methods used, and interest in obtaining information and supplies. Using information gained from the rural extension agencies and the survey, veredas are selected for introduction of the program and methods of communication and education are chosen.

The first approach to the community as a whole is usually through open meetings, preferably organized by the rural extension agencies. The field worker explains the existence of the program, the importance of family planning, and the intention to establish the service in the village. The reaction observed at these initial meetings is an important pointer to the way in which the campaign of information and motivation should be conducted. It is important that the first group discussion cover subjects other than family planning - for instance, nutrition, the local economy, and, in a general way, what is needed to develop the area. Most rural people in Colombia do not respond well to a direct approach on the subject of contraception, and it must be introduced cautiously via other, less controversial, topics. For this reason the field workers work closely with the rural extension agencies and take a very active part in the courses (sewing, cooking, manual arts, nutrition, and others) that these organizations run for women, men and young people of both sexes.

When the family planning message is taken up it must be clear, concise, concrete, and simple. It has been our experience that these people are interested in all matters that have a direct bearing on their lives but have little if any interest in the demography of their country or the continent. Care must be taken, however, not to disturb their traditions or religious beliefs, hence, the importance of using local people as motivators. By emphasizing the relevance of family planning to their lives, the field worker can increase interest in and lower resistance to the program. Once contact with the community has been established through such meetings, the field worker can form a more personal relationship with the families through home visits, during which she will try to help them with their particular domestic problems. Gradually, the subject of family planning can be introduced in more depth.

Films and folk drama have been especially effective means of communication in rural areas. Attendance at meetings is much higher when a movie is advertised. Preferably the film should concern rural development or family planning, but any film is good as a draw in rural regions. Folk theater in the form of short social dramas on family planning, written and acted by the field workers and members of the community, is an excellent means of attracting attention and of putting across the message, with the additional advantage of being a stimulating amusement that encourages creative activity in the village. Illustrated pamphlets and wall charts also have proven to be effective ways of communicating the family planning message.

Distribution posts. The field worker's next task is to find a man or woman in the vereda who will assume responsibility for distributing contraceptives and keeping certain records. Sometimes this step is taken while the initial educational phase of the program is still going on. The decision to begin actual services is made by the field worker on the basis of the particular circumstances obtaining in the vereda.

Almost always, someone regarded as a leader in the village will be suggested by the local people as the best person for this job, and, indeed, someone who is already respected and trusted by the community will have greater influence. If the field worker takes sufficient care in explaining the program and encouraging this person (usually a woman), she will generally agree to distribute the contraceptives. In those rare cases when she refuses, the field worker chooses someone else who has shown interest or another person suggested by the people. The field worker then gives the distributor careful instructions on the program and her duties, and supplies her with pills, condoms, spermicides, and registration and other forms for record-keeping. The distribution post is generally in this person's own home or a local store; posts also have been established in schools, rural cooperatives, and even in local police stations.

It is a general principle of Profamilia that anyone benefiting from the program should contribute something, however little, for the service. Therefore, in the rural program contraceptives are sold for a small fee, which is much less than the commercial price. One cycle of pills is four pesos (US$0.16). The distributor keeps half the price in return for her services and turns over the remainder to the field worker. This small income gives her an interest in seeing that women continue to purchase contraceptives. When a woman fails to return for more supplies, the distributor visits her and encourages her to continue.

When a woman first comes to the distributor for contraceptives, the distributor makes out a registration card. This card is prestamped with a code that identifies the distribution post, and with a number, which becomes the identification number of the acceptor. The distributor fills in the date of first acceptance, name of acceptor and spouse, address, acceptor's education, number of children living and dead, number of abortions, age of youngest child, monthly income, and family planning method chosen. These statistics are carefully recorded and used on county and national levels to plan future programs.

At the same time, the acceptor is issued an identification card that, in addition to name, contains the same distribution post code number and acceptor identification number. This card must be presented for the purchase of contraceptives. And the participant is also given a book (carnet) of 24 coupons, each one marked with the distribution post code and her number. With each purchase of a cycle of pills, the distributor tears out a coupon, which she later turns over to the field worker. The coupons serve to indicate the volume of oral contraceptives sold by each post each month and the length of use for each participant. Carnets are not issued for the purchase of condoms and spermicides. These three forms provide the basis of the statistical recordkeeping and follow-up system, and for the administrative and evaluative work at higher levels.

Conclusions

The Profamilia Rural Family Planning Program has now been in existence for about four years. In 1974 there were 370 distribution posts operating in 60 counties of six states, and about 12,400 families had participated in the program. The number of participants in the program suggests that the rural population in Colombia feels a need for family planning services, despite a tradition of opposition.

Profamilia believes that the program has demonstrated that an organized family planning effort is feasible in even very rural areas.

The outline of the program given here shows that it is based, operationally as well as administratively, on the concept of virtually independent modules or work units. Each zone functions separately in providing services and collecting statistics, which are then fed into a central office. This modular structure seems particularly well suited to a rural endeavor which, by necessity in developing countries, will almost always start small. If successful, it can later expand over a large area because it can be applied to and accommodate any size of program without altering the basic organizational and administrative structure.

Manpower and financial constraints have been reduced by using local residents with a minimum of training as motivators and community volunteers as distributors of contraceptives. More importantly, however, it is felt that their dedication, enthusiasm, and cooperation have been indispensible to the success of the program. The experience of participants taking oral contraceptives without direct medical supervision strongly suggests that systematic control of contraceptives by physicians is not indispensable as long as medical attention is available when necessary. This fact, perhaps more than any other, has made family planning services in rural Colombia viable.

[Extracted from "Development of the Profamilia Rural Family Planning Program in Colombia", Studies in Family Planning, Vol. 6, No. 6, June 1975, pp. 142-147. Copyright© The Population Council, New York.]

LEFT: A Profamilia post in Colombia.

Village Family Planning— The Indonesian Model

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[Indonesia has very recently begun a program for bringing family planning services directly to rural villages, which is obtaining unusually high levels of response. Of particular interest is the method of letting different provinces organize their services to fit local cultures.]

The Indonesian National Family Planning Program has evolved through a series of stages designed to make family planning services more widely available while stimulating a movement to institutionalize a small family norm. The goal of the program, contained in the 2nd 5-year plan, is a 50% reduction in the 1970 birth rate by the year 2000. In 1967 the Indonesian Government first became formally associated with family planning when President Subarto signed the World Leaders' Declaration on Population. In 1970, following a period of less formal organization, the Government created the National Family Planning Coordinating Board (BKKBN) in the Ministry of Social Welfare. The BKKBN has its own budget ($15 million for 1975/76) and staff at the provincial and county levels as well as 6,600 fieldworkers.

Initially the BKKBN focused on offering family planning services without cost to users through health clinics on the densely populated islands of Java and Bali. Since 1974 it has expanded its effort to 10 provinces in the Outer Islands. During the initial stage of family planning based on health clinics, an effort was also made to win the support of formal as well as informal community leaders and create a general awareness and support for the program among the

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the people both in urban and rural areas. Following the acceptance of family planning ideas and concepts at the national and provincial level of govenment the family planning program was extended in early 1975 to villages through the establishment of village contraceptive distribution centers (VCDC) and sub-village family planning groups. This phase is currently underway on Java and Bali, with a goal of establishing at least one VCDC in each village. A next step in the process will be the integration of family planning with other developmental programs at the village level through satisfied acceptors and committed informal leaders.

Program Results

During seven years, the family planning program has increased new acceptors to the program on Java and Bali from 53,103 in 1969 to 1,078,894 in 1972 and 1,785,908 in 1975. Over this period, a total of 6.5 million new acceptors have been recruited on Java and Bali. These results, it should be noted, were achieved largely through the conventional type of family planning program depending on a clinic base, with fieldworkers moving out from the clinics into the villages to motivate couples to seek services at the clinics. In addition, there was some outreach through "Traveling Medical Teams" that move into remote areas in jeeps and vans to offer a variety of family planning services. Only since mid-1975 has village contraceptive resupply been readily available on Java and Bali.

Of interest is the change over time in the methods mix from largely an IUD program in the early years to a pill program. In 1969/70, 55% of new acceptors were using the IUD, and only 27% the pill. By 1975, 68% of the Java and Bali new acceptors were pill acceptors, while only 12% of the new acceptors choose the IUD. In 1975 there was considerable variation of contraceptive selection by province. Bali reported 49% of its new acceptors as having chosen the IUD, while Yogyakarta reported 53% of its new acceptors as choosing the condom. Noteworthy is the fact that the big provinces of West, Central and East Java are predominantly pill provinces, with 83%, 62% and 69% of the new acceptors respectively choosing the pill.

In Table I, incidence and prevalence results of the program through March 1976 are shown, along with the provincial differences in methods of contraception. The cumulative incidence (total new acceptances) ranges from a low of 6.3% in the Outer Islands where the program is quite new to a high of 63% in Bali. In terms of current use, as of March 1976 it is estimated that 4.0% of the married women aged 15-44 (MWRA) are using contraception through the national program in the Outer Islands and 21.2% on Java and Bali, with 32% rates in Bali and East Java.

Table I. Estimated Incidence and Prevalence of Contraceptive Use, March 1976

Province	Cumulative New Acceptors to March 1976 as % of Married Women Aged 15-44	Estimated Current (March 1976) Users as % of Married Women Aged 15-44				
		Pill	IUD	Condom	Other	Total
Jakarta	32.0	5.1	6.4	.9	.4	12.8
West Java	31.0	12.3	1.5	.5	.3	14.6
Central Java	40.6	9.0	6.4	1.3	.2	16.9
Yogyakarta	62.0	3.6	9.7	3.8	.5	17.6
East Java	59.0	20.3	10.3	.9	.2	31.7
Bali	63.0	3.5	26.3	1.6	.6	32.0
Total Java and Bali	46.0	13.1	6.9	1.0	.2	21.2
Total Outer Islands	6.3	2.7	.8	.4	.1	4.0

The characteristics of couples accepting family planning though the national program are of interest. Are these the urban well-to-do, or the rural poor -- those that need the services most, yet can least afford them? In Table II, the characteristics of the family planning acceptors for the 3rd quarter 1975 are listed. These data are from a 10% random sample of new acceptor record cards. It appears that the acceptors from Java and Bali are somewhat different than those from the Outer Island. Acceptors on Java and Bali tend to be younger, have fewer living children, be less well educated and desire fewer children than those on the Outer Islands. The program on Java and Bali tends to be an older, rural one which reaches proportionately more of the poor, while the two-year-old program on the Outer Islands is still relatively urban oriented, with more husbands in government service or trade.

An even more important question is with regard to the impact of the program. Is it, in fact, preventing births? The program is clearly reaching younger women with fewer living children than it originally did. In the 3rd quarter 1971 the median age and parity of an acceptor was 29.5 with 3.8 living children; by 3rd quarter 1975/76, age had fallen to 27.7 and parity to 2.5. This reflects a 6% reduction in age and a 34% reduction in living children of new acceptors over this period.

Unless these couples are substituting private family planning for participation in the national program, or just spacing out a large family, it seems reasonable to assume the program is having some impact on fertility in light of the percentage of estimated contraceptive use. The government is conducting a large three phase intercensal survey with a 250,000 household listing. This survey will go far toward answering many of the questions about the effectiveness of the program, and the reliability of the family planning service statistics system. Preliminary fertility data from a sample vital registration project currently underway in 10 sample kebupatens (counties) of Indonesia indicate that crude birth rates for the period 1974-1975 are well correlated with the percent of MWRA using contraceptives through the national program in these counties. These sample data point in the direction of a relatively rapid reduction of birth rates in those areas where the program has been most active.

Table II. Family Planning Acceptor Characteristics
(3rd Quarter 1975/76)

	Java/Bali	Outer Islands
Average age	27	29
Women under 30	67%	50%
Parity - average number of living children	2.54	3.88
Acceptors with 3 living children who do not desire additional children	40%	28%
Acceptors with less than 6 years of education	52%	30%
Acceptors whose husband is a farmer, laborer, fisherman or unemployed	83%	51%

Reaching Beyond the Clinic

As of 1974, family planning services and contraceptive supplies were available in some 2,500 clinics, free of charge, across Java and Bali. By then it was realized that the program on Java was to be heavily oriented toward the pill and (to a lesser extent) the condom -- both methods that depend upon resupply for effective use. Although the IUD had been promoted vigorously, this clinic-oriented method continued to decline in popularity. From 41% of all acceptances in 1970, the IUD had slipped to 11% of acceptances in 1974. Even though

fieldworkers and clinics were paid an incentive to recruit IUD acceptors, the IUD was selected by fewer acceptors, and the incentive has since been abandoned.

During 1974 the dialogue between Jakarta and the Provincial BKKBN's was increased with emphasis on how to maintain program momentum and increase program activity in lagging areas. This "dialectic process" led to the conclusion that an effort had to be made to simplify contraceptive resupply in order to prolong contraceptive use with the pill and the condom. Also, it became evident that the program would have to move out of the clinic if it were to avoid the supposed "plateauing" that has bedeviled other large national family planning programs. In order to attract younger, lower parity women into the program, services would have to be made more convenient, more readily available, and internalized into the way of village life. Accordingly, the family planning program on Java and Bali began to shift out of the clinic. In attempting to move to the villages a few basic concepts have been followed.

First, the BKKBN decided not to standardize or dictate in detail to the six provinces on Java and Bali. Each province was directed to move as quickly as possible to introduce family planning at the village level, but specifics of the approach were left to the provinces in order to harmonize family planning with the cultural nuances of the area. Second, it was decided to move incrementally and focus first on resupply, with emphasis on making it easier for those who had already accepted to obtain contraceptive supplies. Third, it was decided to link the village contraceptive resupply program to a "mother clinic". Contraceptive supplies, with the assistance of the fieldworkers, would flow from the clinics down to the villages, with each village depot linked to a family planning clinic. This would keep the village family planning movement within the clinic's service statistic system so that activities could be monitored, and enable the clinic to exercise control and supervision over village activities. The clinic should be responsive in supporting the village in terms of side effects, questions about supply and so forth. Some methods used in the major provinces were the following.

West Java. Village contraceptive distribution began to be discussed in West Java as early as 1973. The stimulus was from individual acceptors, who quickly perceived there should be an easier way of obtaining contraceptive resupply (the West Java program is 85% pill). Accordingly, in 1974 a small R & D project was designed by the BKKBN to test a variety of methods of introducing contraceptive resupply in the village, thus obviating the monthly trip to the sometimes distant clinic. It quickly became evident that the system of establishing a resupply depot in the home of an acceptor who was also an informal village leader was the most workable. The depot

holder was resupplied by the fieldworker from the clinic who brought the village's monthly contraceptive supplies. The fieldworker also reviewed the depot holder's record keeping and advised on any complaints during the previous month.

Following this pilot test, this system was rapidly expanded throughout West Java and there are now about 1,600 village distribution centers (VCDC). In West Java one village (a unit of local government) may be spread over a fairly large area and broken into several "kampongs". Following the establishment of the VCDCs in West Java, family planning groups were quickly formed at the kampong level and leaders elected to go to the village VCDC to obtain contraceptive supplies. In West Java and other provinces the leader of the VCDC usually receives the equivalent of $2.50 a month, while the kampong family planning groups are volunteers. All appear to enjoy participating in the program and see it as an important community development activity. An interesting sidelight has been the venturing of some of the West Java family planning groups into other village development activities. Some groups, formed for the purpose of family planning, have branched out into sewing, cooking and nutrition courses and other cooperative type activities. Such extension encourages other women to join the group.

Central Java. Village distribution of contraceptives was initiated in Central Java on a small scale with provincial funds in 1974 and then expanded rapidly in March 1975 with central funding. The system differs somewhat from that of West Java as the village distributor is usually a member of the village headman's staff. In late 1975, the Governor of Central Java ordered that the village contraceptive distributor be made a member of the Village Social Institute under the Ministry of Interior. There is a Village Social Institute active in each one of Central Java's 8,315 villages which is responsible for overall village development activities.

In Central Java, if a woman does not appear for her monthly supply the VCDC operator will sometimes deliver the supplies to the woman's home. As in West Java, at the sub-village level family planning groups called "Pagayuban" have sprung-up around the concept of sending the leader to the VCDC to obtain the monthly supplies. These groups have shown interest in branching out from their family planning activities. One group visited in early 1976 had started a chicken cooperative.

East Java. Village contraceptive distribution in East Java was initiated by order of the Governor in September 1974, and funds were provided to expand village distribution in early 1975. The VCDC operator in East Java is usually a member of the village headman's staff; his duties are primarily contraceptive resupply and acceptor follow-up and maintenance. In some of the villages in East Java, a special "pill

day" has been organized in which all the women assemble at the same time for resupply. The VCDC operator often reads the roll of all registered users of contraceptives and as each woman's name is called she comes forward and pays 35 rupiah (about 95 US cents) and receives her next month's supply of pills or condoms. She is asked if she has had any difficulties to report. Most women don't, but those who do are turned over to the nurse-midwife who visits the village on pill day to provide care or advice.

Of the 35 rupiah received from each woman, 10 are kept for the costs of record keeping and the other 25 are added to a rotating lottery fund. This ingenious feature is a combination of respectable gambling and a savings account. One person each month wins the prize until each person has won. Sometimes it amounts to over Rp 4,000, which is enough to buy material to clothe a family for a year, to lend out at 5 or 10 percent a month, or to repay debts. In this system the luckiest winner gets her investment back in the first month. The least lucky may wait ten years, but as one observer noted, "In our rosy dreams, we are never the last." The lottery acts as a magnet for new acceptors: old acceptors encourage others to join in order to enlarge the payout. Young marrieds are eager to join in order to have a chance at the prize, which would provide them with a welcome fund for starting off their new life.

Bali. Bali's system is somewhat different than the village family planning systems on Java. It revolves around the "banjar", a sub-village organization of which there are some 3,600 on Bali with an average population of some 600 per banjar. In the Balinese scheme of life, the banjar combines religious (Hindu) tradition with secular and local official functions. It is, in effect, their social security and as such is extremely cohesive and self-reinforcing. The banjar family planning system not only includes contraceptive resupply, but also a registration and mapping system in which family planning users are followed-up monthly and their status noted on a prominently displayed banjar map. As the Bali program is largely an IUD program, less emphasis has been placed on contraceptive resupply and increased emphasis on recruiting new acceptors and maintaining those already in the program. Currently 1,800 banjars are participating in the program, and in these about 60% of the eligible couples are using family planning. All banjars are expected to be covered by the end of 1976.

In summary, the guiding concepts of Java and Bali village family planning have been non-standardization; maintaining a link to the clinic in the movement to the village; focusing first on contraceptive resupply; and the concerted effort to integrate family planning services into the village in order to make family planning easier and more attractive. An unexpected spillover of this movement has been the development of sub-village family planning groups with the

desire and energy to expand their activities beyond family planning into self-help developmental activities. It may be that bringing family planning users together creates an unexpected dynamic.

Evaluation of the VCDCs

Data have not yet been assembled that could demonstrate the specific effects of the VCDCs. The VCDC program has moved too quickly to allow the setting-up of control areas - none of the villages would agree to being left out. There is a positive relationship between contraceptive use by province and the number of outlets per MWRA (married women aged 15-44). In Jakarta and West Java, for example, where there are still few outlets per MWRA, contraceptive use is relatively low. In East Java and Bali with many outlets, contraceptive usage is 32%. Some provinces have been relatively successful in establishing and operating the VCDC system in under one year, due to the grassroots demand for this service plus the strong support of the government at each level of administration from the province to the sub-village.

One measure of VCDC success is the rate of utilization. In absolute terms, the number of cycles distributed has grown rapidly though erratically. From BKKBN statistics it can be ascertained that in April 1974 about 20% of the contraceptive supplies were distributed outside the clinics through an "informal" system that had been operating. Fieldworkers would hand-carry supplies for neighbors who, for one reason or another, could not come to the clinic. From this informal system the program has moved to the more formal systems described above. By March 1976, 56% of all pills were distributed through the VCDCs or their attendant family planning groups.

The numbers of new acceptors for Java and Bali increased rapidly in 1969-72, but the trend in acceptance growth appeared to be leveling off (plateauing?) from 1972 to 1974. Then in 1975, new acceptance growth increased again coincident with the inception of the VCDC across Java and Bali. There were other new developments occurring at the same time, but the VCDC was by far the most dramatic. Both the age and the numbers of living children of acceptors have continued to drop consistently from 1971-1975. The median age of new pill acceptors declined slightly until 1975 when it fell sharply, indicating younger women with fewer children than those who came to the clinics.

[Extracted from an unpublished report prepared for the U. S. Agency for International Development, June, 1976.]

China's Experience with Motivation for Family Planning

Leo A. Orleans

[China's methods of stimulating motivation to follow family planning practices are unique, and while they are not readily adaptable to other countries they are of interest in view of their importance for this country's very large population.]

The earliest family planning programs in developing countries concentrated on reaching the population through the standard channels of mass media - radio, newspapers and magazines, family planning posters and pamphlets, and a variety of mailings, primarily of visual educational materials. All these continue to play an important part in the birth control persuasion effort around the world, but over the years it has been clearly demonstrated that as important as mass media are, they can be only one of the approaches to the desired goal. This form of propaganda usually is more effective in a more literate urban population which is already in the process of changing its way of life - one that includes migrants from the rural areas who are integrating into the urban society, gradually shifting their allegiance from the family to society as a whole. Mass media are much less likely to be effective in a rural population - to convince the illiterate masses they must change the traditional point of view toward children and family, or to induce a young couple to adopt contraceptives and limit the size of their family. In the rural setting (and in the urban too, for that matter) more and more effort in "selling" family planning has been concentrated on the more intimate, interpersonal form of communication that makes more use of local personnel and attempts to tailor the message to the specific audience addressed. This approach

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came about slowly, following lengthy experimentation with other methods of communication and still faces many difficult problems such as the recruitment of credible and trustworthy disseminators, matching the message to the local customs and proprieties, and increased costs.

But even the much more effective personal approach still runs smack into the problem of motivation. In other words, the use of contraceptives or the will to be sterilized does not necessarily follow the abstract knowledge about "how" and "why", but usually requires an additional motive that is more personal and immediate. To cope with the problem of motivating people to limit their families in rural areas of developing countries that have not yet experienced significant social and economic changes, governments and interested organizations have been experimenting with a variety of ways to compensate families or individuals who do make an effort to limit the number of children. Many of these schemes have become quite imaginative and go well beyond the payment of cash and material goods that are still widely used, especially to induce persons to accept sterilization or agree to an insertion of an IUD. More sophisticated approaches are becoming common. There is a district in Taiwan, for example, that has been experimenting with education bonds to cover tuition to parents who have no more than three children. And in South India, a savings deposit scheme has been introduced to provide old-age security for parents who agree to limit family size. Theoretically, such inducements are superior to cash payments, but understandably, peasants who are not accustomed to long-range planning will be difficult to convince. In addition to compensating those who agree to accept some method to control family size, incentives have also been provided to "change agents" or "finders" of individuals willing to be sterilized or to wear an IUD, for example. Although the use of negative incentives - increased taxation, withdrawal of certain benefits, other penalties - has been suggested, the idea is quickly abandoned because the people most affected by these measures are already too poor to pay taxes, and so miserable that additional penalties would be counterproductive for the country and would hardly be noticed by the family.

Aside from the question of political and ethical acceptability, incentives can become quite costly and, if delayed benefits are involved as in the case of educational costs and old age security, they can also involve complicated and expensive administrative activities. Witness: Almost one-quarter of India's total family planning budget for the 1969-74 5-year plan is designated for incentives. Despite these high costs, however, there seems to be no other form of effective motivation available to the developing countries so that from the government's point of view the prices paid for incentives is still smaller than the cost of bearing and raising a child.

During the 1950's China also undertook the standard approach to disseminating family planning information. In the first birth control

campaign the mass media was fully mobilized. Information was presented on the radio, in movies, in special exhibits and slide presentations and, of course, in the thousands of articles in newspapers and magazines and millions of pamphlets, posters, lantern slides and other visual aids. A certain amount of personal testimony and persuasion was also given by opinion leaders such as local cadres, doctors, and others in influential positions. This was not enough, however. The population was not yet adequately motivated to accept this media-intense but personally remote approach. Neither were the masses ready to be influenced by intangible incentives to delay marriage and space births in order to contribute to the "Socialist construction of the fatherland."

Today, family planning communication and motivation in China are so different from those found anywhere else in the world that a direct comparison is impossible to make. The number of articles in the Chinese printed media discussing some aspect of family planning is rather limited, yet the national objective to reduce the country's birth rate is communicated in a campaign that is as intensive and persuasive as any that the Chinese have ever launched. Although posters, pamphlets and the ever-present public loudspeakers are still widely used in family planning education, primary reliance is centered on the political and social structure of both the urban and rural communities. Even the role of the public health personnel - the role so vital in the family planning program - is essentially related to technical aspects. It is much more the responsibility of what the Chinese refer to as grass-root organizations, which often include friends, neighbors, and working associates, to educate the young people in the need for the postponement of marriage and, within the marriage relationship, to persuade them to seek the birth control assistance that is provided by the public health personnel - physicians, nurses, barefoot doctors, and other medically trained individuals.

As for monetary or other financial incentives, they are obviously out of the question in China; but the exhortations to serve the people and the fatherland that had minimal influence for family planning in the 1950's have become much more effective with the new, post-1949 generation. Sincerity in China is almost impossible to judge. The praise of the leadership and of fellow comrades (albeit often organized) may not be the greatest reward, but it is very important in the new society, where esteem is accrued through public recognition and disapprobation through public criticism. China is now reaching a point where at least part of this approval or disapproval depends on the size of a couple's family and, as will be seen, constitutes adequate motivation for the planning of births.

Motivation Chinese Style

First there is, of course, the Communist Party, which plays a leading

role in promulgating all policies announced by the regime and whose members are in key positions of all organizations involved in the birth control program. Party members coordinate and lead the activities of labor unions, women's federations, the Young Communist League and other mass political and social organizations which play such an important role in all national campaigns and are now deeply involved in educating and persuading people to plan births. It is usually these organizations that, in conjunction with the public health organizations and personnel convene provincial and county level birth control work conferences. The national involvement in family planning is well illustrated by the following statement from one such conference:

> Under the party's centralized leadership, the trade unions at all levels and the youth, women's, poor and lower-middle peasant and militia organizations as well as the relevant departments such as culture and education, public health, industry, commerce, civil affairs and public security must work together closely to jointly make a success of birth control work.

After a conference participants are informed of the latest policies and plans and have an opportunity to discuss the various measures and approaches and to "exchange experiences," returning to their communities to "implement the spirit of the conference".

Since family planning is a national policy it is also the responsibility of each local government with its authority vested in a Revolutionary Committee. Most of the Revolutionary Committees have established a Committee on Planned Childbirth consisting of at least one member of the parent committee and, for the most part, women from rural production teams or urban neighborhoods who are involved in civic activities, education, propaganda, or some function relating to the status of women in the community. They also include either a full-time or part-time health worker who is capable of providing more specific information with regard to birth control means and methods and who constitutes an important link with the public health system. At the lowest residential levels there are Subcommittees on Planned Childbirth which function with close collaboration with or as a part of street committees which are extremely important in the social, political and economic life of each neighborhood.

Now let us consider more specifically some of the forces within a given community that are more likely to influence a young couple's decision with regard to size of family and spacing of children. One or both members of the young married couple are likely to belong to a branch of at least one of the already mentioned mass organizations such as the Youth League, Women's Federation, Trade Union - each of which plays a very prominent role in their lives. Membership depends to a great extent on compliance and conformity and on activism and participation.

To belong is to support and implement national policies and, as a national policy, the planning of births is of concern to the total membership. Furthermore, virtually every young person, man or woman, is presently in the labor force. The involvement of the management of the institution or enterprise and of the other workers and employees or peasants in the personal lives of each individual extends considerably beyond work-related subjects. "Experience exchange" meetings and discussions go beyond production quotas and problems, and study topics related to family planning are common, particularly "on the eve of big holidays" and especially in institutions where women constitute a large proportion of the labor force. It is not unusual for the women workers in a factory, for example, to announce their joint decision as to the number of births they will collectively have during the following year, or to see a chart on the wall of a hospital or an office again indicating the planned number of births for some specified period of time.

At the residential level, the peer pressures are even more pervasive and certainly more personal. The street health center and the village health room are the focal points of birth planning. It is here, for example, that our young married woman will probably have her name, along with the names of other women in her neighborhood, on a wall chart that depicts the menstrual cycle of each woman, the type of contraceptive the couple uses, the presence of absence of the husband and other pertinent information. It is also from these residential health centers that local women, who may be responsible for no more than 20 to 40 households, are designated to oversee the family planning program, stay in touch with mothers and potential mothers, and personally guide and assist them in the practice of their birth control functions. These basic-level cadres or activists constitute the backbone of the birth planning program. Residential meetings, so common in China and dealing with everything from garbage disposal to domestic problems, are also convened to study and discuss the specific problems relating to family planning, from advantages of marrying late and types of contraceptives to abortion and sterilization. The meetings are usually led by women cadres from the health services or from one of the mass organizations. They know the Party line, how to interpret it and how to communicate it to the group. With the constant reminder both at work and at home about the desirability of having few children, it would be extremely difficult for our young couple - and especially for the female - to slip up.

This special character of the pressures that motivate the Chinese family in the planning of births is aptly analyzed by Professor Liu:

> Since peer group pressure is extensive and intensive, reactions to pressures tend to be circular, involving not one or two individuals as in the case of intergenerational pressures, but a larger number of friendship circles, all of which are proximate, and their collective force far exceeds singular pressure.

The infrequent suggestion by overly-enthusiastic cadres that a more direct approach be tried, one that would "lay down a few hard and fast regulations, so that time could be saved and quick results produced," are quickly rejected with the admonition that success can only come by relying on the "consciousness of the broad masses."

Although the public (or group) discussion of sex-related subjects is in no way typical of the Chinese culture and could only be instituted gradually and with difficulty, the process was undoubtedly helped by the fact that privacy, so valued in Western societies, is virtually non-existent in China. Even more so now than in the past, the community or neighborhood will, as a matter of course, arbitrate domestic quarrels, know every detail of a person's or family's financial status, help a family with a mentally disturbed or retarded member, and so forth. It is only within this social and cultural environment that the effectiveness of peer pressures in the planning of births can be adequately understood.

Despite claims of considerable progress in breaking down traditional attitudes, the Chinese do admit that "family planning work is by no means a soft task" and occasionally report the problems encountered by persons responsible for propagandizing planned parenthood. Here is one interesting case history from Shanghai:

> A woman worker in a toy factory already had two girls. Influenced by the idea that "boys are better than girls," she herself, her husband, and her mother-in-law all hoped for a boy. The neighborhood committee cadres and propagandists went to their home to do ideological work, explained the advantages of planned parenthood, and convinced first the woman and then her husband. Finally, the cadres and propagandists and the couple worked on the mother-in-law. Birth control measures were adopted promptly.

This case not only shows the perseverance of the neighborhood planned parenthood cadres and the personal approach they are able to take, but also reflects the persistence of traditional attitudes even in the cities, and the continuing influence of the older generation in the lives of young Chinese people.

This involvement and intimacy in the current family planning program is also well illustrated by a relatively new approach which parallels China's contention that "along with the practice of planned economy there should also be the planning of births." Apparently in some of the more advanced communes and in some urban neighborhoods, married women of reproductive age hold meetings at which detailed plans are made as to who in the group will have children during the forthcoming years. The discussion takes into consideration such factors as the size of present family and the length of

marriage; the final plan, often represented on wall charts, shows that Mrs. X will have her next child in 1975, Mrs. Y and Mrs. Z in 1976 and so on. These discussions are guided by members of birth control committees or public health workers who follow the edict that:

> In deciding on population plans, it is necessary to have the masses participate fully, to send the plans to each household and work out plans for each person, so that the leadership will have definite plans and the masses will clearly understand them.

Another example of the workings of this system was reported by Han Suyin. She tells of how each courtyard in Peking held meetings to debate which of the families would have a baby the following year. "The families have to agree, between them, whose turn it will be to have or not to have a baby." Apparently one woman got pregnant out of turn, which meant that her neighbor, who was scheduled to have a baby, would not be able to do so. To show her public spirit, the pregnant woman had an abortion.

The story tells us of the system and of the spirit that exists in China. Their approach to family planning does not resemble any methods to be found in any other country. Everyone is expected to be involved in the new ideology and habit of "practicing birth control for the revolution." And when everyone is involved there is a different feeling among the participants; perhaps a feeling of togetherness rather than one of isolation when a family as a single unit has to bear the attention and the pressure of family planning personnel. The practice of birth control in China may not yet be "a compelling demand and spontaneous action of the masses," but there does seem to be a reasonable basis for the statement made at a Kweichow Province conference on birth control work that "the new custom of regarding birth control as honorable is gradually forming in the towns and countryside throughout the province" - and probably throughout most of the country.

[Extracted from China's Experience in Population Control: the Elusive Model, pp. 26-32, prepared for the Committee on Foreign Affairs, U. S. House of Representatives. U. S. Government Printing Office, Washington D. C., 1974]

Population Policy and Research

Ronald G. Ridker

[This article reviews the evidence on possibilities for restraining population growth through a variety of government policies (other than family planning programs). Areas in which policy effects might be found include: education, especially female; employment generation, especially for women; income distribution; incentive programs; social security; health; mass media and urban planning.]

Within the broad spectrum of proposals aired at the Bucharest World Population Conference in 1974, the two policies most commonly advocated for reducing population growth in poor countries were: rapid economic growth, and more effective family-planning programs. The former, it is believed, creates the desire for smaller families, and the latter provide the means. There is evidence to support both positions. No country has ever achieved a high standard of living without experiencing a significant decline in its birth rate. Nor has any sizable country in modern times experienced low birth rates over sustained periods in the absence of significant economic growth. Moreover, some hopeful signs in one or two of the developing countries indicate that birth rates may fall in the next few decades before development reaches high levels.

There is also growing evidence from a variety of countries which suggests that easier access to the information, services, and supplies provided by modern family-planning programs is effective in reducing the gap between desired and actual family size. The extent of the effect in relation to the effort involved is difficult to judge because of substitutions between methods, simultaneously occurring social and economic changes that also influence family size, and difficulties in measuring levels and

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and quality of effort. But there is no reason to doubt that such programs are capable of reaching and influencing those persons who are already motivated or easily encouraged to have small families.

For countries with good prospects for rapid socioeconomic development and reasonably good administrative infrastructures, sustained efforts in both these directions may indeed prove to be sufficient, though the time lags involved could be substantial. The most difficult problem arises in those countries that cannot achieve adequate rates of development in the near future, just because of rapid population growth. In such cases, the number of persons desiring small families may not grow fast enough to give even the best-run family-planning program enough to work on. If population growth is to be curbed reasonably soon, such countries must search for a third approach. This article surveys current progress in that search. Each topic presented here focuses on one hypothesized socio-economic determinant of fertility believed to be amenable to policy manipulation. [Names mentioned in the text below refer to authors of other chapters in the book from which this article was extracted.]

Income and Its Distribution

A wide array of mixed results are found in studies that attempt to relate income to fertility. Some find a positive, others a negative, and still others a shifting relationship as family income rises from low levels; in a few studies no relationship at all is found. Part of the reason is weakness in the available data. Income, for example, should ideally mean the full family income a couple expects to receive over their lifetimes, not the money income received in a particular year and certainly not some per capita average. Most important is the failure to separate statistically the demographic effects of income from those of other variables: practically all socioeconomic variables that might be important in explaining fertility are also correlated with income.

Julian L. Simon divides these income studies into two groups: those that are more appropriate for measuring short-run, direct effects of income, and those that come closer to measuring the long-run total effects. Since the immediate effect of an increase in income is to make it easier to finance marriage and support children, one would expect the short-run, direct effect to be positive: more income encourages larger families. This is just what Simon finds. In constrast, the long-run, total effect tends to be negative, at least above the lowest income levels.

Unfortunately, these findings are of little help in making policy recommendations. The short-run effect is positive rather than negative; to take full advantage of the long-run effect requires sustained economic

development (which presumably is being pushed as fast as it can be in any case). More to the point, these findings are too general and unspecific to be useful for policy. The effect of a change in income is likely to vary depending on whose income is being changed (which socioeconomic groups and which family members), how it is changed (through transfers, changes in the labor market such as increased wages or opportunities for more work, or changes in the ownership of wealth, for example), and whether the change is considered transitory or permanent. It is at this level of detail that we are likely to find useful policy suggestions. For example, while the short-run effects on fertility of an increase in adult male earnings and in opportunities for child labor are likely to be positive, both the short-run and the long-run effects of an increase in female wages, or opportunities for work outside the home, could well be strongly negative.

Recent thinking about economic development has shifted somewhat away from an emphasis on general economic development toward a concern for the poorest segments of the population. Frustrated attempts to raise national growth rates to acceptable levels in some countries, growing evidence that the poor often do not participate in whatever national growth there is, and recent concerns that the rural poor may have to be enlisted in the development process if adequate supplies of food and agricultural raw materials are to be forthcoming for other segments of the population have all come together to explain this new emphasis. Parallel with this shift in focus of development programs have come suggestions that redistribution of income might also encourage a more rapid rate of decline in the birth rate. Typically, the poorer 60 percent of households receive 30 percent of the national income but have fertility rates some 50 percent higher than the richer 40 percent of households. If socioeconomic development were concentrated here, perhaps the national birth rate could be reduced by a larger amount per dollar of investment than it could by an across-the-board approach.

The little evidence that is available is certainly encouraging. But several questions can be raised: First, why <u>should</u> a redistribution of income in favor of the poor be effective in lowering their birth rates? If the argument is based on the assumption of emulation of upper-income-class norms, it is not at all certain which way completed family size would be affected. Is it the desire of lower-income groups to emulate the consumption patterns , or the completed family size, of the rich? If the former, the poor should now be having fewer children than do the rich, and an increase in their income would raise their fertility. If the latter, fertility would fall with an increase in income as the poor acquired the knowledge and means to purchase modern contraceptives. But surely a cheaper way to close this gap in knowledge and means would be through a focused program of family planning. And if the argument is based on the long-run, total effects of the change in absolute level of income, we must ask whether the total effects are likely to occur as a consequence of income

redistribution alone - that is, without concomitant changes in the provision of social overhead capital and other structural changes, including urbanization and occupational changes, which are normally associated with modernization and development. Unfortunately the evidence is based on data that do not permit us to answer such questions. It is virtually impossible to hold cultural and institutional variable constant in cross-country comparisons.

The overall impression with which one is left is that unconditional transfers of income to the poor, while they could well be effective in lowering fertility in the long run, operate through a wide variety of other variables associated with modernization and development. If one is to speed up the process, either these other variables must be identified and the most critical ones changed as a package along with income (or the capacity to produce income), or the transfer must be made conditional upon an appropriate fertility response.

Economic Value of Children

No one would claim that children are desired solely or even primarily because of their value as productive economic assets, but it would be a rare case in which this consideration was entirely absent. And so long as it is present to some degree, the economic benefits and costs of children are worth investigating, for they are far more capable of being influenced by policy than are most of the noneconomic values associated with children. The two principal components of the economic value of children are: the net contribution that children make to the family's income through their work (their production minus their consumption), and the contribution they make later in life to the support of aging parents. Unfortunately, the available evidence is not only spotty and scarce, it is also ill suited for policy analysis.

Attitude surveys, anecdotal evidence, and even some a priori reasoning suggest that raising children provides some net economic benefits to parents, at least in peasant societies. But after carefully sifting through the evidence Eva Mueller finds that children are usually a heavy economic burden. Up to some age between fifteen and nineteen they produce substantially less than they consume; indeed, aggregate production does not equal aggregate consumption, even by a male, until some time in his twenties, when he begins to have his own children to support. This finding is particularly significant, first because Mueller makes an extreme effort to find positive asset values for children at birth (for example, by choice of assumptions on hours of work, wages and consumption, and by not discounting), and second, because if such values are negative in peasant societies, they are surely negative for the rest of society, in particular for urban areas where the costs of child rearing tend to be higher and the possiblities for contributing to family income at early ages tend to be lower.

This conclusion is supported by evidence indicating that in developing countries children under the age of fifteen do little economic work (that is, work contributing to marketable output), and that their productivity when working, even during peak seasons,tends to be low (productivity being judged according to the wages that would be received for the same work in the marketplace). It can be argued that this definition of productivity excludes housework by children. But since children also create the need for additional housework, a correction for this factor is unlikely to change the overall result significantly. It can be pointed out that the use of wages, even during peak seasons, represents an underestimation of the importance of having children available to fill in when needed. But it is difficult to believe that day labor hired during peak seasons would be more expensive than children who have to be supported throughout the year. School attendance by children under fifteen partly explains the low labor-participation rates by children found in these studies; but low attendance rates and the possiblity of fitting farm work in around school work suggest that this is not the principal reason. The most likely and obvious explanation for these findings of low child labor-participation rates is simply that labor in general is in excess supply in the countrysides of the developing countries with which we are dealing. If this analysis is correct, we must reckon with the likelihood that efforts to increase agricultural output will result in increased employment opportunities for children along with those for rural labor in general. Thus, the scope for policy intervention to decrease the demand for child labor is quite limited. The relevant bits and pieces of econometric, historical, and sociological materials combine to suggest that while a decline in demand for child labor will lead to a decline in fertility, the effect is likely to be small and the time lags involved quite long. Given that child labor-participation rates are already low, plus the likelihood that agricultural investments may increase the demand for child labor, there is little room for manipulating this variable by itself.

The evidence with respect to old-age support is mostly qualitative and indirect. It emerged strongly in attitude surveys in countries where strong family ties are traditional, but little is known about the actual extent of the transfers. Mueller finds that older rural males continue working on family farms until very close to the age of death and thus may not be receiving substantial transfers from their children. But little is known about the kind and productivity of the work involved or whether this finding is applicable to those without the opportunity to work on family farms. Moreover, labor-participation rates for older women are considerably lower than for elderly men, suggesting that some transfers must be forthcoming at least for them.

Perhaps more to the point, one can ask whether investments in children are the best way to provide for one's needs in old age. Robert G. Repetto makes a plausible case that they are not: there is no certainty of a child's surviving and being willing and able to provide support; and

there are periods during the life cycle when surpluses are easier to accumulate along with mechanisms to transfer these surpluses to later stages in life. Land could be purchased in small increments; durables like gold ornaments etc., can be accumulated; and even those in debt could increase their uncommitted income significantly by reducing their indebtedness.

On the other hand, there are sustantial risks involved in attempting to save and transfer surpluses from one period to another over one's lifetime. Farm investments are illiquid; money and jewelry can depreciate or be stolen; commercial institutions can go bankrupt. Indeed because of inflation and the risks of theft, fire, floods, confiscation, and other calamities, the perceived long-run rate of return on many possible investments may well be negative. At least the peasant may feel that the situation is too dangerous to rely on any one approach, so that he may prefer to save and to have children in case one of these approaches fails. The cost of bringing children into the world is not very high, and the costs of supporting them are spread over at least ten to fifteen years. Accordingly, even if the economic return for having a child is negative, it may be less negative than alternative investment. In any case, all such arguments may be overshadowed by the fact of long widowhood in societies where women have little economic power and even less knowledge of economics. To them, children, and especially sons, may appear to be all that will save them from destitution after their husbands are dead, no matter what the economic facts may be.

Efforts to improve access to savings institutions and to reduce the risks and improve the returns from such invesments would be helpful in reducing the pension value of children, as well as being useful for general economic development. So, too, would the promotion of life insurance, private pension plans, and other contractual savings arrangements, since they tend to bring about a net increase in the average rate of savings. Government-sponsored social security programs would help; but they can be quite costly.

Education

The linkage between education and fertility poses a paradox for both researcher and policy maker. On the one hand, no other socio-economic variable seems to have a stronger negative association with fertility. Parents with more education have smaller families, and parents whose children have more education also have smaller families. These relationships hold in both cross-section and time-series studies at both the national and the family levels, and whether or not other variables such as income and place of residence are controlled. While in some studies it has been found that the relationship is positive for families with only a few years of primary education - suggesting the possiblity that it is necessary to achieve a certain threshold before the negative impact takes hold - these are exceptions

to the general impression to be derived from reviews of the literature. On the other hand, research has not provided adequate explanations for these correlations, with the consequence that most policy recommendations in this area remain on uncertain ground.

The Effect on Parents' Desire for Additional Children. It is difficult to foresee what kinds of effects on parents' tastes and preferences might arise solely from providing more education to their children. But there are several income and price effects that could be important. First, the additional years of schooling place two burdens on the family budget: they reduce the income which children would otherwise contribute to the family and, depending on the way in which costs of education are met from private payments, they increase the direct cost of rearing children. Second, the additional schooling increases the parents' expectations of receiving larger income transfers from a given child later in life, reducing the number of children needed to help with old-age security. And third, if the effective price of schooling were reduced, it could become more profitable for parents to invest more in fewer children, substituting "quality" for "quantity."

Doubts can be raised about the importance of these effects, especially in peasant societies. The direct costs of sending children to public schools, especially in primary years, is typically small, and is offset by the baby-sitting function served by schools (the value of this service is smaller where older children are available to care for younger). Moreover, economic transfers from better-educated children later in life are far from certain, not only because of high death rates but also because educated children are more likely to leave the extended family network of ties and obligations. Unless death rates fall and the net returns to education are increased significantly, parents may not be willing to give up security in numbers for improvements in quality. In any event, the time lags involved in trying to persuade them to do so are likely to be substantial. Nevertheless, even small changes add up over time.

The Effect on Children's Subsequent Fertility. Here we can be somewhat more confident of finding a significant negative effect on fertility. First, there are a number of attitudinal changes associated with the acquisition of education that are likely to reduce the desire for a large number of offspring, independent of any income/cost effects. Education, according to Donald B. Holsinger and John D. Kasarda, increases exposure to appeals in the communications media aimed at encouraging family planning; increases aspirations for upward mobility and accumulation of wealth, making one less interested in - or at least more desirous of postponing - the rearing of a large family; imparts a sense of ability to control one's own life and environment, thereby making family planning and the use of contraceptives appear less foreign; and encourages

one to think about nontraditional ways of living one's life.

Working in the opposite direction is the income effect of education, which makes it possible for the better educated to afford large families. But as Dennis N. De Tray points out in reviewing studies attempting to separate and measure the income and cost effects, the latter are all negative and appear to be sufficiently important quantitatively to offset the positive effects of income on fertility. These cost effects are thought to be of the following types: education of women enhances opportunities for employment that are competitive with having and rearing children, thereby increasing the opportunity cost of children. Education of both parents tends to raise the educational norm that they expect to provide to their children, thereby raising the cost of child rearing. It also seems to increase the capacity for effective use of contraceptive devices, and for communication between husband and wife about such sensitive matters as family size and the use of contraceptives (thereby lowering the effective "cost" of achieving a given family-size norm). Since school and marriage are generally considered incompatible, the provision of more education tends to delay the age of marriage. Education helps parents reduce child mortality, thereby lowering the number of births required to achieve a given family-size norm and encouraging investments in quality rather than quantity. Finally, as a consequence of increased education, parents are more likely to be able to take care of themselves in their old age, thereby needing children for this purpose to a lesser extent. Information on the magnitude of these effects, however, is scarce and generally of poor quality.

School Attendance. If education is of value, then the principal need is for more facilities and teachers. Given the budgetary constraints in low-income countries with rapidly growing populations, any additional resources made available to the education sector must be allocated with care. Highest priority should be given to primary education in poor rural areas where birth rates are highest. An immediate antinatalist effect might be introduced by allocating facilities within this high-priority area on a conditional or incentive basis - that is, to those rural villages meeting certain family-planning targets.

But lack of facilities is not the only problem: available facilities are frequently underutilized because of poor attendance. There are four possible ways to ameliorate this situation. The first, compulsory attendance laws, can be set aside as unworkable. The second, subsidies or monetary incentives for attendance, does not seem promising in view of budgetary stringencies. However, the subsidy could be given only to those families with fewer than a certain number of children, as is being tried experimentally in Taiwan. A third possibility is to improve the relevance of education to the individual's

daily life. A peasant has little incentive to keep his child in school if he believes that the child is not receiving much of value. One way to enhance the value of education is to change the environment in ways that increase the need for education. An education is of little value to a girl who will never take a job; even literacy is of little value unless there is some need to read. Suppose, for example, that jobs in the education and health sectors requiring a certain number of years of schooling were made available to girls. Such a change could make the difference between sending and not sending a daughter to school. However, there is little or no evidence available so far to measure the effectiveness of these presumptions and suggestions.

Mortality, Morbidity, and Nutrition

It is frequently alleged that a fall in child death rates and better health and nutrition are necessary preconditions for a fall in fertility. Cross-country and historical evidence tend to support this proposition. But what role do these health-related factors play, independent of positively correlated changes in income, education, and social structure?

Improvements in health, while not necessarily increasing the number of births, do increase the capacity to have more children. William P. Butz and Jean-Pierre Habicht find good evidence that raising the nutrition level of females results in earlier menarche, later menopause, and shorter periods of postpartum amenorrhea in nursing mothers. The linkage between male fertility and morbidity probably works in the same direction, although Butz did not find any evidence to this effect. Reductions in adult mortality, because they decrease the number of widows and widowers of reproductive ages, also increase the potential for more births. Only reductions in deaths among nursing infants point in the opposite direction, since the period of lactation and postpartum amenorrhea are therby made longer; but the contraceptive effect of this change is far from sufficient to account for the observed declines in birth rates as infant death rates have fallen. If the correlation between morbidity, mortality, and fertility is to be explained, one must look for behavioral rather than physiological changes.

First improvement in general health and a decline in child mortality can be expected to increase desired family size, since the expected cost of rearing a survivor is thereby reduced and the benefits increased. Second, a decline in child mortality means that fewer births are required to achieve a given number of survivors. T Paul Schultz shows that, given plausible assumptions about response elasticities, the net effect of these first two factors is to reduce births. But this decline in births is unlikely to be sufficient to offset the increase in population growth resulting from the decline in mortality unless additional behavioral factors are brought into play. One such factor is the response

of parents to uncertainty. A plausible response is overcompensation: parents may well prefer to have too many rather than too few surviving children. If this is the case, a reduction in child mortality, which is generally accompanied by a reduction in uncertainty as well, would reduce births by somewhat more than is implied by the first two factors alone. Fourth and perhaps most important, improvements in the rates of mortality and morbidity and in nutrition at all ages increase the relative returns on investments in human capital. These effects should encourage parents to invest more in both their own and their children's education and health, and make them willing to have fewer children in order to finance such expenditures. They could also make it somewhat more attractive to postpone marriage to the extent that marriage and early child rearing are incompatible with investments in education.

While all these effects are plausible and more or less consistent with the evidence, there is very little information on their quantitative magnitude and none that adequately separates the various effects and lines of causation, including the biological, from each other. It is typical in less developed countries to find that the decline in child death rates precedes the decline in birth rates by at least a decade, and that the decline in the latter compensates for less than the total decline in the former, leaving family size and the growth rate of population somewhat larger. But the variance around this average is sizable: Schultz, for example, finds that in about half the studies he reviewed response rates in excess of unity are implied, and an explanation for these differences is lacking. One cannot go further than this with the data, virtually all of which are cross-sectional, and the methods available at present.

It seems reasonably certain that improvements in medical and health care will eventually encourage some decline in fertility. Beyond this statement, however, lie many unanswered questions, particularly concerning the extent and speed of the decline, the resulting effect on the population growth rate, and the overall cost-effectiveness of alternative methods of improving medical and health care. One suggestion may be offered as an example of the kind of focus in health programs which might have pertinence to their fertility effects. The major causes of child mortality are gastroenteritis and diarrheal diseases. Public health investments in providing potable water and sanitary waste-disposal systems in rural areas, plus education campaigns directed specifically at this problem, should have a high rate of return independent of general advances in economic welfare.

Female Roles and Labor-force Participation

Some studies have indicated that high fertility rates in many develop-

ing countries are related importantly to the social and economic roles assigned to women, and that the best way to change this situation is through changes in female employment. Women in a large number of developing countries, and especially in the rural sectors of these countries, are described by Ruth B. Dixon as powerless, economically and socially dependent, and isolated from the mainstream of life outside the family circle. In Moslem societies, on which she concentrates, this situation is related to the practice of female seclusion. Among other things, it leads to limitations on economic activities outside the home. This makes daughters a greater economic burden on their parents, resulting in their receiving less education and leaving them with fewer ways to attain status and security besides early marriage and the production of children. While arising for different reasons and in different guises in non-Moslem societies, the more general features of this situation are not unfamiliar in large parts of Latin America and Africa.

The possibility that provision of better wages and jobs for women outside the home could change this situation and lead to a decline in fertility arises for two reasons: the roles of worker and mother tend to be incompatible; and a job and an independent source of earnings may give a woman a greater voice in family decision making.

James L. McCabe and Mark R. Rosenzweig, however, note several reasons why a positive relationship between female earnings and fertility may occur in developing countries. First is the income effect, allowing families to afford more children, which could be much stronger at low levels of income. Poverty forces many women into the labor market when it means a reduction in the care their children get; for these women, an increase in their wage rates could well permit them to work less, increasing the amount of time they would have to bear and rear children. Second, large families make it easier to find substitutes for the mother's time in child rearing. Finally, the jobs for women in developing countries often permit caring for children while working, since they are more often performed at home than jobs in industrial countries. Role incompatibility, therefore, cannot automatically be assumed in conditions prevailing in developing countries. To ensure a negative effect on fertility, the additional jobs provided for women must be deliberately chosen or designed to be for the most part incompatible with child rearing.

The second factor presumed to lead to a decline in fertility, the greater voice in family decision making resulting from a job, is stressed by Dixon. There can be little doubt that girls with an independent source of income are in a better position to resist pressures to marry than are those without jobs. Moreover, evidence suggests that there is a positive correlation between the extent of the wife's involvement in family decision making and use of contraceptives. But once again, whether the provision of jobs per se under

conditions prevailing in poor rural areas would be sufficient to encourage a greater role in decision making, and whether that in turn - independent of other changes - would lead to a decline in fertility, is open to question. It is more likely that a number of changes together - the provision of certain kinds of jobs and conditions of employment and pay, possibly combined with a self-help organization to provide education, legal and psychological support - would be required for a significant, sustained effect to be observed.

Dixon proposes the establishment of rural industrial cooperatives employing only women, or special workshops or industries for women. Several objections can be made to this approach. First, all proposals involving the development of new institutions and special projects are difficult to establish, replicate, and operate as self-supporting enterprises on a large scale. Second, investments in such special projects are often expensive on a per-person basis. Third, such efforts may fail if the male unemployment rate is too high, because men will either preempt the jobs or demand that the investments be made in directions more directly useful to them.

These problems with the special project approach have led some to argue that it is more effective to concentrate efforts on reducing the general unemployment rate and allowing the demand for female labor to increase as a natural consequence. Such a trickle-down approach seems to account in part for the increase in female employment in Pakistan, where, according to one commentator, women began to be employed in traditionally male jobs when better -paying jobs for men opened up elsewhere. But the immediate impact of such policies could well be pronatalist since they imply an increase in male earnings before female employment increases. Indeed, it could even result in some reduction in the supply of female labor as women, no longer forced by poverty into the labor market, withdrew to devote more time to child rearing. In some cultures, across-the-board efforts to increase the demand for female labor do not provide the package of changes that may be necessary to obtain a commensurate increase in the <u>supply</u> of female labor.

Fortunately, however, these two approaches are not mutually exclusive. While everything should be done to lower the general unemployment rate, there is no need to wait until it is reduced to acceptable levels to begin experimenting with different institutional forms and interventions in the female labor market. Such experimentation can proceed on a sufficiently small scale that it does not threaten male employment. It is only when some success has been achieved and attempts are made to expand the scale of operations that a conflict between these two approaches may arise.

Urban Residence

From sample surveys that include information on respondents' residential locations within two metropolitan areas, Ankara and Mexico City, David Goldberg finds that a significant proportion of fertility-related behavior is explained by residential location, over and above the effects of respondents' income, education, and place of birth. It is not possible to determine from his data whether this association is the result of a self-selection process - persons with similar attitudes tending to live in the same area - or whether people tend to take on the characteristics of those around them. Most likely, Goldberg suggests, both effects are present, but to the extent that the second explanation is correct a possibility for influencing fertility patterns presents itself. If planners were to locate urban infrastructure and renewal programs in such a way as to encourage small rather than large migrant clusters, and to encourage less segregation between older and newer migrants, perhaps the new migrants would become urbanized - and in the process give up their high fertility patterns - more rapidly.

Influence of the Media

It seems plausible that exposure to the mass media could influence preferences and tastes in ways that might have some effect on fertility behavior. Such exposure may inculcate new attitudes by increasing the desire for advertised products, the purchase of which would compete with the rearing of children, or by inducing identification with reference groups having fewer children or a later age of marriage. Deborah S. Freedman reviews the literature and evidence pertaining to possibilities involving the use of mass media and modern consumer goods. There are serious methodological problems in trying to judge the indirect effects of mass media, and data are very scarce. From what little there are - in particular a survey of Taiwanese husbands - Freedman finds evidence indicating that even after eliminating the effects of income, education, and ownership of modern objects an increased exposure to mass media is associated with increased use of contraceptives, higher consumption aspirations, lessened fears of child mortality, increased awareness of the costs of children, etc. The effects are small, but not much smaller than the effects of income and education (in that sample). Thus, there is a possibility that the promotion of mass media, and especially television, might have some impact on fertility. It could be objected that such a policy would encourage undesirable luxury consumption at the expense of investment. But the mass media can carry any desired message; it is not necessary that they encourage profligate styles of living. Indeed, Freedman's Taiwan data suggest that aspirations for and ownership of "modern consumer goods" are positively correlated with savings.

Some Broader Policy Implications

Several policy issues cut across all aspects of population problems. The first issue is that of incentives - that is, changes that are conditional upon a favorable change in fertility-related behavior. Incentives could be considered in conjunction with education, public health, housing, or the provision of employment opportunities for women. The second issue is the need for a group of closely related and mutually reinforcing changes. Finally, we must consider the question of priorities: given all the possibilities we have surveyed, can we say anything about which is likely to have the highest benefit-cost ratio, defining benefits and costs to include more than just the economic magnitudes involved?

Incentives. A wide variety of incentives has been suggested and a number are being tried. They can be positive (payments for acceptance of a vasectomy, for example, as in India) or negative (increased hospital and maternity fees and lower priority for public housing for parents with larger families, for example, as in Singapore). The incentive can be provided to the couple themselves, to "motivators," or to the community at large (funds for public works projects dependent on achievement by a village of low fertility targets, for example). They can be provided for changes in behavior ranging from the use of a particular method of family planning, changes in the age of marriage, increased spacing, or smaller completed family size. They can involve transfers of cash, goods, or services (the Taiwan education bond and the Pakistan proposal to offer life insurance for the oldest son, for example). Such transfers can be immediate or deferred (as in the case of the tea-estate experiment in India, in which payment at the time of retirement varies inversely with the number of children). While evidence on the effects of such schemes is sparse at present, it is likely to improve substantially in the next few years as the new schemes under way mature to the point at which evaluation becomes feasible.

Whatever their nature, there are several arguments in favor of incentives. First, they are known to work in other fields: price incentives can induce farmers to shift to new varieties, and differential tax rates can encourage investments in some fields and discourage investments in others. Second, the conditional nature of the offer reduces the social cost and risk involved in policy changes that would otherwise be difficult to reverse if the expected fertility effect is not forthcoming. For example, if a pension varied inversely with the number of children a couple had, the pronatalist effect of the higher lifetime income would be counteracted, and the schemes could be set up in such a way that no pensions would be provided unless fertility actually fell. Incentives can also help to overcome the time lags inherent in fertility-related forms of social change. For example, the

principal effect of additional schooling on rural youths is felt only after they become adults; but if this schooling were offered on the condition that their parents limited family size, some of the effect would be shifted to the present child-bearing generation.

Finally, and most important, the use of incentives obviates the need for knowing in detail the nature and strength of the principal determinants of fertility. Incentives should work so long as something considered to be of value by the recipient is provided, whether or not it fully compensates him for the loss he incurs from having fewer children. It is the perceived, not the real, value of children that counts in gaining such acceptability. Some argue that people want to limit fertility but do not have effective means. Others assert that individuals have reason to limit fertility but are not sufficiently motivated because of lack of knowledge and the persistance of old attitudes and values. Still others argue that given the environment within which parents in less developed countries live they do not have good reason to lower their fertility, and cannot be motivated to do so in the absence of substantial changes. Incentives can be effective no matter which of these explanations is correct. If the first is correct, the incentive will induce people to find effective methods or demand that they be given them. If the second proves to be correct, the incentive will help speed up the adjustment process. If the third explanation is correct, the incentive serves as a substitute for the social change that has not yet occurred. At a minimum it will change behavior without affecting attitudes; but given normal dynamics of attitude formation, changes in attitude will follow the changed behavior in order to justify and rationalize the latter, thereby reinforcing the behavioral change.

There are, of course, a number of arguments on the other side. The incentive may have to be quite large, causing budgetary and possibly also political problems. Some types of incentives may be considered distasteful. Implementation of incentive programs sometimes poses difficult administrative problems among which are possibilities for the misuse of funds. And a number of persons might receive payments who would have behaved as they did in any case.

Whatever stand one may take with respect to incentives, they do appear to be an excellent instrument for experimentation. Indeed, the doubts and questions about incentives can probably not be answered otherwise. How else, for example, can one determine how large the incentive must be, or whether the administrative problems can be solved, and whether favorable or unfavorable changes in attitudes are likely to occur as a result of their use?

A Package Approach. A group of closely related and mutually reinforcing changes are likely to be much more effective than a piecemeal approach. An incentive for girls to postpone marriage will be far more

effective if combined with increased opportunities for them to use their time constructively. The provision of increased educational opportunities may not be taken advantage of unless it is clear that the education is useful and needed and that it opens up additional job opportunities. Mass media may stimulate the desire for a higher standard of living, but the result will be frustration unless opportunities are provided for improving the standard of living.

To induce parents to value "quality" over "quantity" will require opportunities to increase lifetime income, better training to take advantage of these opportunities, reduced mortality to increase the expected returns from long-term investments, and, quite possibly, some kind of community or peer-group support to encourage the individual to break with tradition and bear the uncertainties involved in a new approach to lifetime planning. But it is a very demanding task to make all these things happen at once, and in trying to do so it is easy to overload local officials and the capabilities of complementary sectors. The problem is to choose just the right set of changes, sufficient to induce the proper behavioral response yet not so comprehensive as to be infeasible. The determination of the appropriate package probably involves more art and intuition than it does science. We can say that a package of changes is necessary, and identify some of its ingredients; we can warn planners not to overload the system; but the right balance and mixture cannot be specified without a large measure of intuition and judgement about specific local circumstances, much of which must be gained through experience.

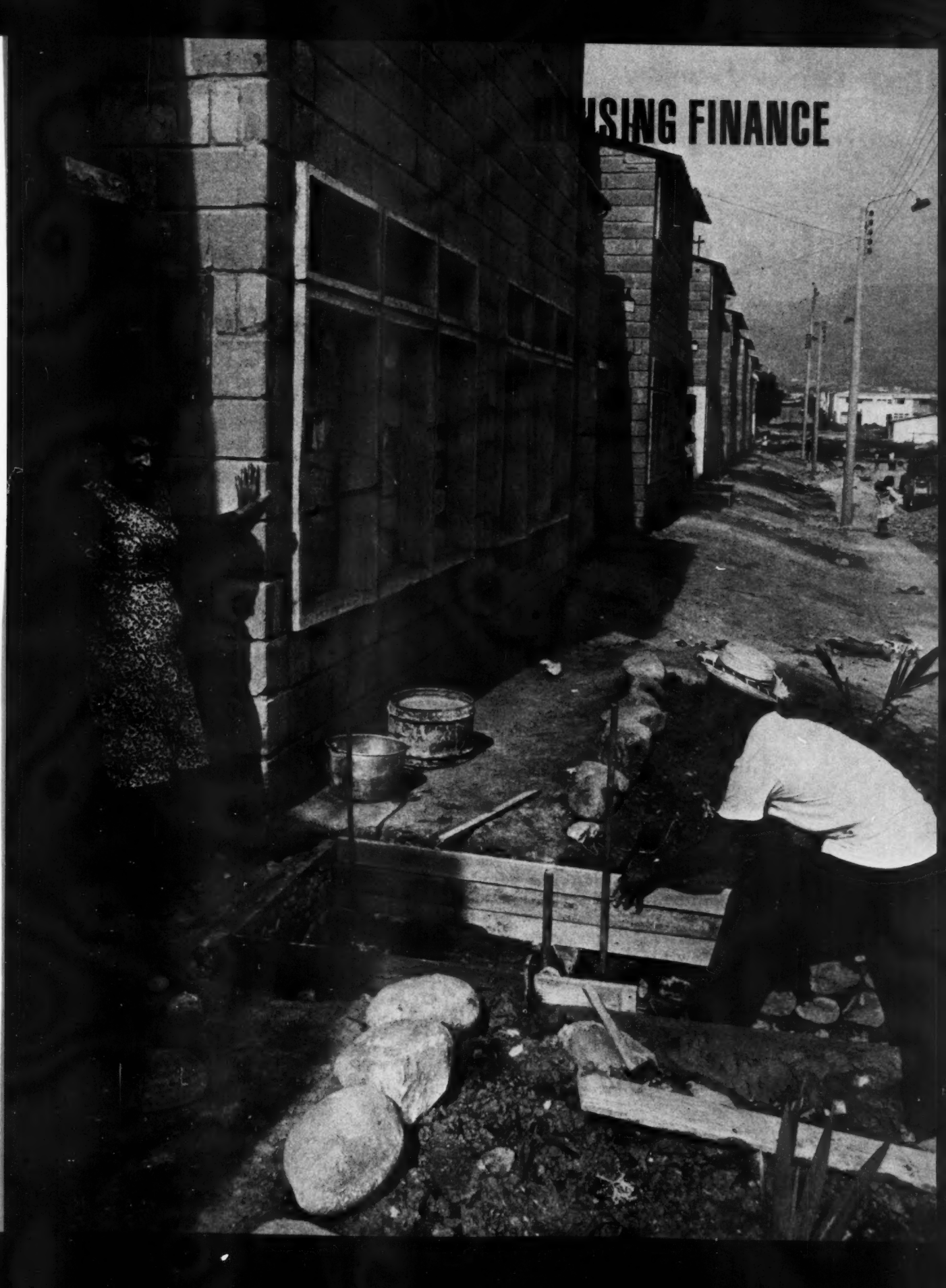
Toward a Priority List. It is impossible to provide anything like a ranking of the various approaches to population policy according to their likely benefit-cost ratios. Educated guesses could be useful if additional information about specific countries were added but are of little value at a more general level. A first step in this direction can be taken, however, by considering the appropriateness of broad classes of policy options depending on the seriousness of the population problem in different countries.

In all cases, of course, countries should start with vigorous programs of family planning. In countries that do not anticipate serious problems associated with population growth, such a supply-oriented approach may be sufficient. But if population pressure is expected to be severe in the future, even though it is not today, and if there are good prospects for growth and modernization in the meantime, it would be useful to add a demand-oriented approach that tries to influence the economic development program in ways that speed up a country's transition to a low-fertility regime. The provision of more and better primary and secondary education in rural areas, especially coupled with an attempt to attract girls into the schools, measures to increase the demand for labor including female labor, the elimination

of discrimination against women in labor markets, and the movement of people out of traditional agricultural areas into more modern sectors as quickly as development permits are all cases in point. It is at least as difficult to establish priorities within this area as it is to indicate how to get general development going. But it is likely that placing an emphasis on such high demographic-impact programs would alter the style and composition of development in significant ways.

As we have seen, a number of the programs that would be included in such an approach can have positive income effects on fertility in the short run; and it could take several decades before the long-run negative effects gathered sufficient strength to offset them. If the population problem is more immediately pressing or is likely to become so before this approach has time to work, more emphasis should be placed on the use of incentives, deliberate efforts to alter preferences (using mass media and other approaches), and special projects (e.g., for women's work) that represent somewhat more direct intervention into the determinants of the family's decision-making process. If, however, the population problem is more urgent yet, creating severe short-term pressures and threatening to swamp the development program altogether, more coercive measures, such as prolonged separation of the sexes through drafts for military and work-camp service, and compulsory sterilization after the bearing of a certain number of children, may be called for. We have deliverately not considered such measures here. If we get on quickly enough with the tasks of developing and testing less draconian policies, we may hope that the number of cases in which they have to be used will be few and far between.

[Extracted from Population and Development: The Search for Selective Interventions, edited by Ronald G. Ridker, Chapter 1, pp. 1-36. Copyright©The Johns Hopkins University Press, Baltimore, Maryland, 1976.]


USING FINANCE

HOUSE BUILDING IN COLOMBIA
(Photo: Inter-American Development Bank)

Housing Finance to Meet Changing Conditions

Robert H. Freed

[Methods of organizing institutions to finance housing and the repayment of mortgage loans are extremely important, both to ensure that funds are available so that houses can be built and to broaden the access of various income groups to home ownership. This article reviews a variety of such methods, indicating which ones are useful for various purposes.]

Each succeeding year, as the world's population grows and urban migration continues, the shortage of adequate housing becomes greater. It is a shortage created not from a lack of building materials, labor or know-how, but from a deficiency of financing. In order to cope with this deficiency, worldwide consideration is being given to changes in the necessary instutions and home financing methods in order to meet the needs of borrowers and lenders and enable more housing to be built.

Evolution of Institutions for Home Financing

Modern financing for homes can be said to have originated in Birmingham, England with the establishment of a building society in 1781. The first such societies had a limited number of members; loans were made one at a time to members as funds became available from the regular contributions by members and from loan repayments. When all the members had completed their homes and their repayments, the funds were returned to the members and the society disbanded. There were no interest or service charges and the loans were short-term. In 1831 the Oxford Provident Building Society was founded in the United States with 37 members. It

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was terminated 10 years later and was succeeded by Oxford Provident No. 2 and then Oxford Provident No. 3. This latter society became a "serial association" in 1854 as it developed a series of separate investment clubs at short intervals, all housed together. At this point fees had to be charged for management and other expenses. Such associations were established only to finance homes and not for savings.

By the late 1800s both the English and American systems had developed into continuous associations in which anyone could deposit money and receive interest. Their role in savings was established. These early associations were mutually owned by their members who shared the profits as dividends in proportion to the funds they had on deposit. Later, stock associations were established for profit by small groups of investors.

Building societies of various types began to proliferate in many parts of Europe during the first half of this century. None of them, however, were able to mobilize the amount of savings of the British or American systems. This was generally due to the low interest rates they charged for loans, which restricted them to even lower rates paid on deposits. West Germany has been the most successful of these countries with a system of contract savings developed during the last 25 years. For example, more than half of approximately 3.5 million public servants are building-savings contract holders. They have a fixed amount deducted from their salaries until such time as they reach a balance that qualifies them for a loan. Institutions using contractual building-savings have also been established in Latin America where they presently compete with both stock and mutual savings and loan associations.

Nearly all countries have also established governmental home financing institutions. These may be funded with general tax revenues, with special purpose funds (i.e., social security revenues), or by the sale of government notes, borrowings from abroad, foreign grants, or by some combination of each of these. They may use their funds to finance public housing programs or lend them to the institutions involved with private sector financing.

Morgage Loans

The nature of home ownership varies. In some countries this is because the land remains public and only the house and improvements may be privately owned. Elsewhere the land may be privately owned but it is leased on a long-term basis to the home owner. Both the house and land might be subject to a long-term lease. And, or course, there is the individual ownership of both.

Customarily the buyer of a house (with or without its land) needs to

borrow money, and can use the house as security for loan repayment, i. e., a mortgage loan. Normally he becomes the owner unless he fails to keep up his payments. In some cases, however, the prevailing system of financing may not transfer ownership to the borrower until such time as a home loan is fully repaid. The lender may hold title to the property under a trust arrangement until the loan is paid in full, or he may hold it under a lease-purchase arrangement in which the property is technically rented until such time as all of the payments have been made to complete the purchase. (Strictly speaking, a lease-purchase agreement is not a mortgage. It is the various conditions of mortgages that we will describe here, but these variations could also be incorporated in lease-purchase arrangements.)

1. Long-Term Fixed-Rate Mortgages with Steady Payments. Since the 1930s the prevalent home mortgage in the United States has had a fixed rate of interest and repayment has been established over a fixed term of 15 to 30 years. The homeowner makes the same pre-established payment each month for the entire term, unless he chooses to make prepayments which shorten the term but do not affect the amount of the monthly payments.

2. Long-Term Variable-Rate Mortgages with Steady Payments. About the same time as Long-Term Fixed-Rate Mortgages were established in the United States, building societies in the United Kingdom established Long-Term Variable-Rate Morgages. Monthly payments were determined on the basis of the rate of interest initially charged for repayment over a given number of years. The initial interest rate was based on the cost of money to the societies, and this could go up or down with changes in the money market. The amount of the monthly payments remained constant for the life of the loan, but the terms of the loan were lengthened or shortened to accomodate interest fluctuations. An increase in interest rates would cause the repayment of the loan to cover a longer period of years. (Recently, because of the higher rates of inflation in the 1970s in the United Kingdom, many monthly payments have been changed with interest rate changes and an effort has been made to hold down the terms.)

3. Variable-Payment Mortgages: Indexation of Principal. The increasing prevalence and high rates of price inflation have led to numerous experiments with variation in the monthly mortgage payments based on changes in a price index - i. e., indexation. Inflation causes increases in both the value of houses and the prevailing interest rates, while it decreases the value of money repaid to the lender by the time he receives it. Long-term fixed-value contracts initiated when inflation was low bring losses of capital and income to lenders when it rises, and loan funds for housing can disappear. However, inflation also raises borrower incomes, allowing them to make larger monthly payments. Borrowers may well prefer to increase their payments rather than stretch out fixed payments over a longer term - which could run as

high as 60 years under the Variable-Rate Mortgage just described. Where inflation is consequential, its rate is typically highly variable. When inflation decreases unexpectedly, borrowers may suffer under fixed-value contracts made to reflect a high rate of inflation. The best way for both parties to accommodate all these risks may be to agree on a formula for indexing the monthly mortgage payments.

Indexed mortgages have been used in some parts of Europe for many years, and recently they have been adopted by many other countries in response to high inflation. Basically, these have a fixed rate of interest for the life of the mortgage, but the outstanding principal balance of the mortgage loan is changed from time to time on the basis of some index and payments are shifted accordingly. The most typically utilized index has been the consumer price index. Several countries, notably Israel, have utilized changes in the exchange rate when dealing with funds from foreign sources. The major devaluation of the Israeli pound in 1962, however, made it impossible for homeowners to maintain payments, and the system was ended. But the problem of meeting repayment schedules in foreign currency remains.

The most thorough-going and successful use of indexation has been developed in Brazil, where both the mortgage payments and the rates of interest on savings in building societies are indexed, so that the flow of loan funds is maintained. (To index only the deposit rates in savings and loan associations without indexing other financial instruments can attract too many deposits to the former at the expense of other types of savings, as occurred in Colombia.) Indexation may become highly complex when different indexes are used for different components, some of which may reflect only a fraction of the changes in value. In Argentina and Chile, for example mortgages were indexed to consumer prices, while monthly payments were tied to minimum wages and these lagged behind; this led to continuously increasing subsidy. Generally, indexing should be consistent if it is to be used.

4. Variable-Payment Mortgages: Pre-Scheduled. Where inflation is less rapid and unpredictable, borrowers and lenders may prefer to avoid the uncertainty of payment flows by establishing a fixed schedule of payments rising by a given percentage each year. This method can also be used, irrespective of inflation, to attract into the housing market young people whose incomes can be expected to increase over time. Often they cannot afford at present income the monthly payments under a fixed-payment mortgage for the kind of house they will later be able to afford; but they would be able to start paying for such a house with a mortgage that scheduled in advance a rising level of payments. These could rise along a curve, not necessarily by fixed percentage changes. This kind of schedule, under which amortization would be slow or even negative in the early years before it began to accelerate, can be calculated so that the lender's security in the value of the house (in case of default) will not fall below the amount of the debt.

This is a relatively new idea, but it is getting some preliminary trial. In 1973, on the basis of a paper by this author, the South Korean National Housing Corporation began a pilot project of 1,500 residences for which monthly mortgage payments increase by a fixed amount every six months, but with a fixed rate of interest. The State of Maryland (in the United States) has a similar pilot project, also developed by this author. Other plans in which payments are systematically increased to match expected price change, or in a direct relationship to the household's earnings, are presently under consideration.

5. Balloon Payment Mortgages. In Canada they utilize a mortgage system in which monthly payments are computed on the basis of a Long-Term Fixed-Rate mortgage. At the end of five years the borrower may pay the total outstanding balance or extend the loan for another five year period at a new rate of interest. If he chooses to extend the loan, payments are determined on the basis of the new interest rate over the balance of the original term. Each five years the process is repeated until the loan is paid in full.

Factors to be considered

It is obvious that the source and cost of money to the local lending institution play a dominant role in home financing. The amount of money available from particular sources and the limitations that are placed on its utilization may often restrict the area of choice. But, given the opportunity to choose among alternatives, a home financing program should consider the risks of future inflation, changes in family incomes, exchange rate fluctuations, potential appreciation in home values, the nature of home ownership, laws regarding delinquencies and foreclosures, and many other things. Governmental programs must carefully consider who they want to reach and what, if anything, the government is willing and able to pay to accomplish its purposes. It is clear that a type of mortgage which functions well in the absence of inflation may be totally inadequate for inflationary conditions. There is a need for special mortgages for special purposes, and especially to bring more buyers into the market.

[An original article.]

Note: This article represents the personal observations of the author, not intended as a statement of AID's policy in the field of housing.

Savings and Loan Societies for Low Income Urban Families

Georges Vernez

[Savings and loan associations specially adapted to low-income owners of self-help housing could be a significant supplement to "sites and services" programs. Guidelines are proposed.]

Housing policies for urban low-income families in underdeveloped countries have typically stressed the public supply of fully serviced "standard" housing units. Measured by the degree to which they have achieved their stated objective, these policies are and continue to be a failure. The high cost of standard housing construction coupled with extremely low effective demand by a majority of the urban population has resulted, deliberately or by default, in the retargeting of these public housing programs to the middle- and high-income minorities. Where targeted as intended the implementation of standard housing has required high public subsidies, so that it has benefited no more than 10 percent of the urban low-income population. As a result, a large proportion of the demand for shelter has been overflowing into so-called squatter settlements that are developing at the periphery of most large-sized cities of the emerging nations. These have three characteristics: 1) the incremental development over a five to fifteen year period of an individual dwelling unit from a modest minimum shelter to a multiroom, fully serviced home; 2) complete control by the builder family over the phasing, design, programming, and construction of the dwelling units; and 3) self-financing of housing construction by the dweller-builder.

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An alternative housing policy for urban low-income families has emerged under the general form of a "sites and services" policy. [See Development Digest, July 1974, pp. 43-62.] This policy encompasses housing service delivery designed to facilitate, encourage, and accelerate the type of "self-help" incremental housing development typical of squatter settlements. The policy maintains incremental dweller control, and in varying degrees the self-financing characteristics of these housing developments. The policy should have the following complementary programs: 1) An unconventional, decentralized savings and loan mechanism designed to capture the savings of the urban low-income sector and to provide multipurpose loans targeted to this economic group. 2) A governmental land bank to facilitate access to landownership by low-income families and guide the physical growth of the metropolitan area. These would be in addition to the provision of basic public services - water, sewage, electricity and roads - and the provision of technical assistance to families involved in "self-help" housing construction, features which are more widely recognized as necessary to the sites and services policy.

The financing of construction by incremental development can benefit considerably more families than is possible by financing complete "standard" dwelling units because the former requires a lower initial investment than traditional housing. In Bogota, for example, the initial stage of construction in squatter housing requires an average investment two to five times lower than is required in minimum government subsidized dwelling units. With respect to other governmental housing programs and to commercial housing, this relationship is 30 or more times lower.

Construction by incremental development accelerates capital formation by urban low-income families. The low-income family is provided property and minimal shelter in squatter settlements much sooner than is possible in any of the other housing submarkets. Often it is their only possibility for home ownership. Investments made in the expansion and improvement of a dwelling unit accrue as captital to the family, and families also benefit from realty appreciation values stemming from rapid urban growth. Capital formation in low-income families is also accelerated because the proposed housing policy promotes investment of idle labor capacity in construction. It is widely recognized that family labor inputs to building by incremental development enable a family to capitalize 40 to 50 percent of the market value of the newly constructed or improved dwelling unit.

Benefits to the low-income family: From the point of view of the urban low-income family, home-ownership and housing construction by incremental development present several advantages. First, the family is able to maintain control over the phasing, programming, and construction of the dwelling unit so as to combine monetary and non-monetary resources - including its own labor - with contracted labor at

its own economic convenience. It also fully uses the nonmonetary economic interchanges that are still a significant part of the urban low-income economy in developing countries. A second advantage is the flexibility to schedule family investments and expenditures for housing and other goods and services as preferred and necessitated by fluctuating monetary resources. In periods of hardship, the family may interrupt housing investment so as to maintain consumption of other goods, such as food and education. In periods of relative affluence, the family can increase its housing expenditures.

A Financing Mechanism for Support of Self-Help Housing

Financing of housing construction by incremental development is typically family financed without the benefit of an institutionalized credit system. An increase in these construction activities, however, will require a financing mechanism for urban low-income families. This financing mechanism should be designed to capture the savings of these families and to provide them with loans. Its design should reflect the need for relatively small investment requirements at each successive stage of housing construction, and it should take into account both monetary income instability and nonmonetary family resources in determining "ability to pay" for housing.

Ability to pay. Two factors can cause the "ability to pay" for housing to be underestimated when it is based on money income alone, as is usual in determining the eligibility for participation in public housing programs. First, this definition excludes non-monetary economic transactions, such as the exchanges of labor inputs in house construction as well as exchanges of food and other home-produced goods and services. These can often be substantial. Second, the income-eligibility criteria are based on nuclear-family resources. In developing countries, however, one should not ignore the mechanisms for income sharing and mutual help which are traditional functions of the extended family. Sociological researchers generally stress the negative role these obligations play for the economic mobility of successful members of the family, rarely recognizing the positive impact such practices have on the resources of a nuclear family. In squatter settlements one often finds families able to buy a lot and build a dwelling unit only because the necessary monetary resources have been provided by relatives.

Income instability among urban, low-income families is another structural consideration in the design of a savings and loan mechanism under a housing services policy for urban low-income families. Monthly fluctuations in disposable income may occur whenever family income is low but fixed, so that an accident may decrease income available for housing. Family income may also fluctuate because of employment instability. Various surveys in squatter settlements of Bogota indicate that one-third to one-half of family heads are occasionally employed.

Guidelines for a savings and loan mechanism: Based on these considerations, the following principles are offered as guidance to the design of a savings and loan mechanism under a housing services policy.

1. Participation in the savings and loan mechanism should include all families presently excluded from access to existing institutionalized housing finance mechanisms. There should be no minimum income limitation on participation because the monetary income of a low-income family is an unreliable indicator of family wealth.

2. No minimum or maximum saving requirements should be imposed on savings deposits. Neither should there be limiting requirements on savings withdrawals, either in time or amount. The low-income family should be serviced with flexibility according to its needs. Higher interest rates could be attached, however, to savings left during a specified minimum time period.

3. The interest rates on savings, or the dividends in the case of savings and loan cooperatives, should be equal to savings interest rates in commercial banks.

4. Perhaps the most important requirement is to relate loan value to amount saved. Such a criterion would stimulate savings, and allow use of "savings" as an indicator of "ability to pay." The loan/savings ratio should not exceed six to one. Loans should be subject to a maximum value depending on local housing material costs; loans are intended to cover housing increments, not wholly completed houses. It is likely that requests for loans will not exceed this ratio. Reportedly, the loan/savings ratio of a savings and loan cooperative in a squatter settlement of Bogota never exceeded two to one.

5. The loan amortization period may vary with the value of the loan, but should not exceed 5 years rather than the usual 20 to 30 years. Typically, amortization periods will be shorter to keep pace with the steps in construction by incremental development. Also, as an incentive for prompt and regular repayments, the amount and period of subsequent loans should depend on partial or total repayment of the initial loan. However, flexibility should be allowed on loan repayments in order to take into account income instability. No penalty should be applied to reasonable delays in payment - one to three months. Conversely, accelerated repayment of loans should be allowed.

6. As a general rule, interest on loans should be established at a rate that covers the entire capital and administration costs, as well as the effect of monetary inflation. If these mechanisms are implemented by the private sector, a normal profit rate should be added to the overall interest rate. These guidelines do not exclude the provision of subsidized interest rates for the purposes of income redistribution and

accelerating low-income housing construction by incremental development, when governments wish to make such expenditure.

7. While the savings and loan mechanism is expressly proposed to support housing construction by incremental development, its services need not be limited exclusively to loans for housing. Credit is also needed to attend to family calamities and for developing local commercial and service activities.

8. Administrative flexibility in the application of the operational criteria for savings and loans is necessary for the system to respond effectively to the needs of low- and unstable-income families. Such flexibility can be achieved only through first-hand objective knowledge of behavior and the economic and other resources of each family. This requirement suggests the need for decentralization of the savings and loan administrative mechanism at the community or barrio level. At the latter level, administrative intricacies can be minimized, periodic family economic hardship can be more easily identified, and, at the same time, community pressure can be used to avoid unnecessary loan repayment delinquency. Intimate knowledge of individual cases should reduce credit risks.

9. The form that the organizational unit at the community or barrio level can take varies by local conditions. Savings and loan cooperatives offer the advantage of minimizing administrative costs, as officers often are willing to function on a voluntary or part-time basis. Additionally, the collective interests implied in the organization structure of a cooperative make control of operations more effective. Alternative types of organization are also possible.

10. Decentralization should be limited, however, to administrative and operational functions, since a community-based revolving fund would probably be too small in some cases and too high in others. A central bank should, therefore, be established with the following functions:

a. Redistributing the capital accumulated according to the demand of the local savings and loan units;

b. Serving as a governmental insurance fund against repayment risks; and

c. Programming the distribution of government subsidies in accordance with redistribution and economic development objectives.

[Extracted from "A Housing Services Policy for Low-Income Urban Families in Developing Countries," Ekistics, No. 242, January 1976, pp. 8-13. Athens, Greece: Athens Center of Ekistics.]

Housing and Social Security in Latin America

Morris L. Sweet and
S. George Walters

[Social security funds are becoming a significant souce of housing finance for workers in some Latin American countries. The methods used in Brazil and Mexico are described.]

Since 1960 there have been major changes in Latin American housing finance, with a decline in the use of the traditional mortgage credit systems and, starting with Brazil, the creation of new national entities drawing upon social security funds. The Brazilian and Mexican programs provide prime examples of the link between social and housing.

Brazil

According to the 1960 census, 8 million dwellings, about one-half the housing stock of Brazil, were considered unfit for habitation. With the population growth, 500,000 new housing units were required to keep the shortage from growing worse. Loans for construction and homeownership, however, had reached a point where credit was obtainable only for very short periods and at extremely high interest rates. A down payment of 40 percent to 50 percent was necessary to purchase a single-family house, and the outstanding balance had to be paid within two or three years. To resolve the housing crisis, Law no. 4380 was enacted on August 21, 1964. It provided

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for the creation of the Banco Nacional de Habitaçao (BNH), which was given the task of formulating a national housing plan and finance system, and also given the sole responsibility for implementing this plan as well as the management of the entire housing finance system. The designation of a bank rather than a ministry reflected a basically financial approach to solving the critical housing problem. The legislation was designed to stimulate construction of low-cost housing and to finance the purchase of privately owned housing, particularly by lower and middle income groups. Some 60 percent of the BNH investments had to be applied to the construction of dwellings for low-income occupants.

Source of Housing Funds. BNH and the Ministry of Planning approached the problem of capitalizing the bank by involving the source of capital with the employment system of the beneficiaries of the housing program, i. e., the future occupants of low income housing. The piecemeal budget allocation was replaced in 1966 by the massive resources of the national social security fund, and savings from the national savings and loan system. The new law mandated employers to contribute an additional 8 percent of employees' salaries into a personal account for each employee held under the supervision of the Central Bank. The contribution is allocated to the Funda de Garantia de Tempo do Servico (FTGS) which is part of the social security system. It was specifically established for the retirement and unemployment benefits of employees, and its resources were made available to BNH. BNH borrows from FTGS at 5 percent, necessitating the bank to obtain at least a 5 percent return from its loans. In 1973, the bank's budget was $1.5 billion.

There is a personal account in each employee's name; and for those employees who so prefer, the employer can hold their account in trust under the provisions of a previous labor law. Deposits for employees receive no interest for the first four years, but from the seventh year, 7 percent in guaranteed. The employee can draw upon this account only for specific reasons: 1. if the employee or member of his family is ill, 2. if he is discharged from his job and remains unemployed, 3. if he retires, or 4. if he wishes to purchase a home through the bank.

Though any Brazilian citizen can use the bank to purchase a home, its policies and operations are directed in favor of low-income families. The interest rate for homeowners' mortgages ranges from 1 percent to 10 percent, depending on gross family income. An employer willing to provide housing for his staff can obtain financing from BNH on an equal-sharing basis; his contribution is usually in the form of land.

The initial allocation of FTGS funds to BNH went to housing; they were then made available for the financing of integrated urban and local government planning, sanitation (water, sewerage, and pollution), training of technical personnel, activating industries for building materials, and construction, electricity, and highways. With the use of FTGS resources, BNH was able to establish the Brazilian Savings and

Loan System, which began to finance middle-income housing, employing the technique of seed capital to inaugurate savings associations.

Monetary Correction. Brazil has pioneered in minimizing the effects of inflation. All financial instruments except equities are pegged to inflation; mortgages are linked to wages. The usual arrangement for mortgages for low-income borrowers is to have the payment set at approximately 25 percent of salaries and, as salaries rise, payments rise accordingly. With the adjustment of the interest rate, the proportion of interest and principal per payment would vary and the amortization period of the mortgage would change.

Results. The accomplishments of BNH, of which the payroll tax is an integral part, have been impressive for a developing country. In a little less than three years after the bank started, construction of publicly aided housing units reached 500,000; in the previous 28 years, they totaled slightly less than 164,000. In its first nine years, BNH financed the building of almost 1 million homes; completion of an additional 2 million dwellings is contemplated by 1980. Some of the worst slum communities in and around major cities have been eliminated.

Unemployment has been reduced; BNH estimates that 200,000 jobs are being created annually from the construction boom, and another 800,000 workers annually obtain indirect employment benefits. In terms of housing, the most significant factor has been the additional investment in housing. "Over the four year period of January 1967 to December 1970, the Bank from this fund and through the multiplier effect of its investment on the employment situation of the country, and in particular the building industry (wherein nearly 500,000 new jobs were created in the year 1969 by BNH investment), through an intensive campaign to reintroduce the habit of savings among the people, and by the sale of real estate bonds (with guaranteed monetary correction against inflation), the BNH mobilized the equivalent of $1,500 million for investment into the housing sector of the country. Its annual budget for 1971 was in the order of approximately $1,000 million, and the system has become almost self-generating, to the extent that is is expected to increase by 12 percent each year." (Morris Judenplatz, 1972)

The accomplishments of the Brazilian financing mechanism are noteworthy, but there remain problems that should be discussed if a balanced picture is to be given. There are questions about the ability of FTGS to continue as the major source of funding for the National Housing Plan. What occurs when the fund has to fulfill its original mandate, that is, social security payments? To prepare for such a contingency, the bank undertook an extensive advertising campaign to increase savings accounts, and began by the sale of real estate bonds with the monetary correction factor to offset inflation. The impor-

tance of FTGS to the BNH is underscored by the fact that the resources secured from the fund are over twice those received from the Savings and Loan System by 1968 (see Table 1).

Table 1. National Housing Bank Resources and Obligations, Brazil, 1965-68
(thousands of U. S. dollars)

	Period to			
	1965	1966	1967	1968
Available resources				
NHB capital	28,030	43,225	62,567	82,729
FTGS	-	-	193,014	465,000
Brazilian Savings and Loan System	-	25,986	84,319	216,820
Obligations undertaken				
Induced savings	3,722	77,356	315,084	776,601
Yielded investments	25,287	142,515	787,725	1,583,450
Units, houses	19,952	57,983	228,396	398,260

Source: National Housing Bank of Brazil

Elimination of the slum communities was not done without having to face the social costs of relocation. One of the first major projects was the construction of new communities on the perimeter of the larger cities planned for the rehousing of the occupants of worst favelas (slums). In spite of dismal living conditions, many were hesitant to leave their traditional communities for sterile, lifeless homes many miles away. Yet their houses were destroyed and they were made to move, and strong feelings of resentment still persist. They frequently are uncomfortable and not adjusted to life in the poorly constructed high-rise buildings or row houses. Most of these communities are too distant from town centers; two or three hours daily are spent on travel in buses. The discontent led the bank to cancel any further forced moves. Another weakness, reflecting in part the forced moves into new housing, is the failure of many low-income borrowers to make their regular monthly payments. This points to the need for better screening of credit applicants, unless, as with the FHA in the United States, political pressures lead to a relaxing of credit standards, with a subsequent rash of defaults. [Comment: Such screening must evaluate not only conventional income criteria for credit worthiness but the desire of individuals for the move, which will affect willingness to maintain payments.]

The aforementioned difficulties are not necessarily due to defects in the underlying legislation but rather arise out of the indigenous

Brazilian political and cultural tradition and from the administration of the legislation. Adoption of the financial model by other countries should not be precluded; there has been international acclaim in respect to the Brazilian model, influencing the housing finance systems of other countries, such as Argentina, Mexico, and Ghana.

Mexico

Legislation enacted in December 1971 (effective May 1972) provided for a major program to meet the need for 2.3 million housing units through the creation of the Instituto del Fondo Nacional de la Vivienda para los Trabajadores (INFONAVIT). It is basically a banking organization with considerable autonomy, whose control is shared by workers, employers, and the federal government. Its resources come from a 5 percent payroll tax on employers. The government as an employer also contributes 5 percent of the wages for its 700,000 employees. Initial operations are financed by an interest-free loan from the government of 2,000 million pesos ($160 million). Wages of farm workers are exempt from the tax. The proceeds from the payroll tax are not considered as part of the workers' salaries, although they do receive benefits at a later time. The payment by companies is deductible for corporate income tax purposes. Firms that had ongoing programs for building or financing homes for their employees had to submit details to the fund in order to have their payroll contribution calculated. Workers in these firms had the option of asking that existing plans for furnishing housing be discontinued and that there be compliance with the new 5 percent payroll tax

A lottery system is used to decide who gets the new housing. Loans to workers are granted without any down payment, at interest as low as 4 percent, with a 10- to 20-year term, and life insurance paid by INFONAVIT. Loans can be used to construct housing, repair and enlarge existing housing, or pay off previously incurred housing indebtedness. For example, a worker earning the minimum wage may purchase a house worth 30,000 pesos (US $2,400) on an installment payment of 190 pesos per month (US $15.20); the worker with an income of 1,800 pesos per month (US $144), one worth 50,000 pesos (US $4,000) on monthly installment payments of 325 pesos per month (US $26.00). Under financing by INFONAVIT, in no case need an employee pay more than 20 percent of income for housing. First priority for this housing is given to stable families with two or more children. The preferred type of housing has an average size of $50M^2$, at the cost of some 50,000 pesos ($4,000). For the first 10 years, although the 5 percent contributions are credited to the worker's account, they are "locked in;" but at the end of the 10-year period, the program should be self-supporting,

and a worker could withdraw the entire principal without any interest payment.

The plans to carry out large-scale construction to the extent of 5,000 million pesos annually ($400 million) for 100,000 low-cost housing units in both urban and rural areas are expected to have a salutary impact on employment. The 100,000 housing units should generate some 126,000 man-years of employment - 74,000 direct and 52,000 indirect. Substantial growth is expected in the construction and building materials sectors. It is estimated that, once the program is in full swing, at least 250,000 new jobs in the construction industry alone will have been created.

Results. After three years, the program set aside a total of 2,250 million pesos ($190 million) in housing credits. Over 4 million workers are enrolled in this program and 44,000 are receiving benefits directly. As of late 1973, INFONAVIT had financed the construction of 51,196 housing units, of which 13,232 were completed, 13,389 were under construction and 9,947 started; 14,626 standard model houses were completed; and it had acquired 19 million square meters of land in a number of cities for future development.

The program should have a strong economic impact on the Mexican economy. In the initial stages, it is considered potentially inflationary. But if the 5 percent payroll tax is the equivalent of a deferred wage increase, there is less immediate purchasing power for workers - that is, assuming workers do not demand pay increases, regardless of the funds set aside for them. For business firms, there are the added costs over the tax deduction features. But there is relief from any direct obligation to furnish housing to employees which could entail considerable expense.

[Extraced from Chapter 6 of Mandatory Housing Finance Programs; A Comparative International Analysis, pp. 89-102. New York: Praeger Publishers, 1976, Copyright © by Praeger Publishers, Inc. Reprinted by permission of publisher.]

INDUSTRIAL TECHNOLOGY

A SMALL COFFEE PROCESSING AND
PACKAGING PLANT IN SFAX, TUNISIA
(Photo: Kay Muldoon for IDA, World Bank)

Industrial Technology in Developing Countries: An Editorial Introduction

Gordon Donald, Editor, Development Digest

A number of development economists and other specialists are reaching the conclusion that the use of technologies developed for conditions in the industrialized, high-wage nations may often retard the growth of industrial output and employment in developing countries. Modern labor-saving machinery can be wasteful of scarce capital resources, and will generate less employment than more labor-intensive alternatives. This position is controversial: Some would argue that efficient alternatives to modern technology do not exist as a practical matter, or that they would not produce the results claimed for them. Others would stress policy problems, i. e., the difficulties of finding ways to bring about technological choices which would be more desirable.

This controversy involves questions of terminology. It has been customary to classify technologies as high (i. e., capital-intensive), low (labor-intensive), and intermediate; and some have advocated the adoption of "intermediate technology" as a general solution for developing countries. Others have objected that the best technological solutions for particular industries and countries need not be intermediate in capital intensity. (Since Western technology has been moving in a direction of capital intensity, the "highest" tend also to be the newest methods in use; intermediate alternatives are often those used in the West some years ago.) Because countries differ in their wage levels and supply of capital, what is needed is the most "appropriate technology" for a particular situation, considering all the factors involved. This terminology gets around the idea that technology must be intermediate, or any other objections that could be raised, but it gives no sense of direction.

Others would remedy this weakness by specifying "low-cost technology" as the solution: a country should choose whatever technology will produce a given product at lowest cost under its particular conditions. One objection to this approach is that prevailing prices for labor and capital may often be the source of the trouble, and they ought to be changed. The most beneficial technology would be lowest in cost after such a change, but not necessarily with existing prices. Another objection is that the cost levels of today will inevitably change, so that the low-cost alternative now may not be the lowest-cost method of the future.

Readers will find the terms intermediate, appropriate, and low-cost applied to technology in these articles. Appropriate technology, the

most trouble-free term for economists, may have an unfortunate connotation when used by advisers from rich countries for application in poorer countries with aspirations for improvement. It might suggest inferiority: what is appropriate for me is not appropriate for you. The promotion of labor-intensive, old fashioned technology may seem to relegate newly industrializing nations to a low status kind of industry - or at best "intermediate" status. Complex modern machines do have status: they are the symbols and proof of progress. Those who distrust the motives of rich-country advisers may conjure up the notion of a capitalist plot, pointing to Soviet mechanization as the triumph of a formerly poor country which has marched to industrial front rank in disregard of conventional theory.

One can point out that the Russians have immense resources of iron and coal; and that the Chinese, who have much less, achieved independence from Russian advisers by developing their own labor-intensive methods. More fundamentally, the question at issue is one of the value of advice from whatever quarter for the nation using it. Industrial status symbols can be costly; they may generate rather little employment for what they cost, displacing other kinds of investment. Foreign advisers offer various kinds of guidelines, sometimes conflicting with one another, and countries must choose what they find best for their own purposes.

The first article below analyzes the wide variety of technologies used in six Indonesian industries. In the second, White assesses the evidence on the range of possible technologies that could be used in industry. Next, Pack examines policies which could bring about more appropriate technological choices. The last two present different views on how to reach the technological goal: Mendis describes how Sri Lanka is promoting indigenous and intermediate technology with cooperatives; Jequier points to the essential role of the individual entrepreneur.

Economic Man and Engineering Man

Louis T. Wells, Jr.

[A wide variety of technologies are being used at the same time within six industries in Indonesia. Analysis of managers' technical decisions and the reasons given for them indicates that many technological differences result from efforts to hold down costs in different situations, while others reflect a mixture of economic with other kinds of motives.]

One of the most perplexing problems facing a number of developing countries is that of unemployment. Industrialization, it is generally thought, has not done its share to absorb labor. It appears that the technology which is used early in the industrialization process is capital-intensive, borrowed from the advanced countries. In the opinion of many, a part of the answer to the unemployment problem is to turn to "intermediate technology," technology that involves less capital and more labor than that in general use in more advanced countries. If the businessman behaves like an "economic man" he should, according to traditional wisdom, choose an intermediate or a labor-intensive technology when operating in a less developed country with low wage rates and high capital costs. By choosing appropriately, he will minimize his costs of production and simultaneously raise employment.

Very little empirical work has been done at the firm level to examine how the businessman actually behaves. This study of technology in Indonesia is an attempt to help fill the gap. Its principal finding is that the businessman probably does not behave solely as an "economic man." Economics puts a constraint

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on his behavior, but he may also have a rival objective as an "engineering man" which appears to influence the design of plants in less developed countries.

The Range of Technology

The first question mark about the appropriateness of the model of the economic man comes when one is confronted with the wide range of technologies that exist side by side in Indonesia. For this study, data were collected on the technology used in 43 industrial plants in Indonesia. Factories were visited in Djakarta, Bogor, Surabaya Malang, and Medan. In six industries, plastic sandals, cigarettes soft-drink bottling, bicycle and betjak tires, flashlight batteries, and woven bags, data covered four or more plants producing comparable products. In four of the six industries, there seemed to be three technologies that lent themselves to classification into "capital-intensive," "intermediate," and "labor-intensive" categories, while in two there were no really labor-intensive methods in use.

The difference in employment created under these alternative technologies is rather striking. To take the cigarette industry as an example, where calculations of the number of workers required to produce one million cigarettes per month are a common measure of automation, the employment implications are significant. In the capital-intensive class, the median of the range of number of workers required was 3; in the intermediate class, 6; in the labor-intensive class, 40. For the volume of cigarettes manufactured by the firms interviewed, this would mean 3,009 workers if all firms were using the capital-intensive technology, 6,018 if intermediate, and 40,120 if under the labor-intensive techniques. Table 1, giving crude estimates of the number of workers required for total production levels using alternative methods, shows that the choice of technology has similarly important implications for the employment in other industries. The number of plants in each group are given in parentheses.

Table 1. Number of Workers Required in Various Industries for Various Technologies (figures in parentheses are number of plants in each group)

Technology	Cigarettes	Flashlight Batteries	Soft Drinks	Tires	Woven Bags	Plastic Sandals	Total Plants
Capital-intensive	3,009(3)	464(2)	279(1)	n.a.(1)	n.a.(2)	230(2)	(11)
Intermediate	6,018(5)	1,392(2)	698(3)	1,207(4)	n.a.(2)	920(6)	(22)
Labor-intensive	40,120(3)	5,568(4)	6,417(2)	7,100(1)	-	-	(10)
Total Plants	(11)	(8)	(6)	(6)	(4)	(8)	(43)

Different Factor Costs

The range of technology observed in Indonesia is partly to be explained by market imperfections that lead different firms to have different factor costs. Each manager may be behaving as an economic man, arriving at solutions to the problem of choice of technology that are different from those of some of his competitors because of the different costs of labor and capital.

It is true that the foreigner is likely to face a lower cost of capital than the domestic firm and that eight of the eleven plants using capital intensive methods were foreign owned. In the case of the two foreign firms listed as using intermediate technology, one had plans to buy new equipment that would put it in the capital-intensive class, and both were employing secondhand equipment drawn from their factories in other countries. No foreign firms were using labor-intensive methods.

Three further bits of evidence are available to support the idea that the breadth of technology might be a response of an economic man to different labor costs. First, the foreign firms rather consistently pay higher wages than do the domestic firms, as Table 2 shows. The differences are large for both the skilled and the unskilled jobs and cannot be accounted for by differences in industry mix, location, or payment in kind. Thus, the foreign plant's choice of capital-intensive technology could result not only from access to cheaper capital, but also from the fact that the foreigner pays higher wages than the domestic enterprise.

Table 2. Wages in Rupiahs[a] per Day, by Type of Firm

Skill Level[b]	Foreign[c]	Domestic [State]	Domestic [Private]
Unskilled	314	227	123
Skilled	503	425	352

[a]One U. S. dollar equaled approximately 413 rupiahs at the time.

[b]Comparable jobs were taken in each industry. Industry by industry, the same patterns of wage differences were evident.

[c]If any of the equity was held by a foreigner, the plant was supposed to be registered with the Foreign Investment Board. This registration was the basis of classification.

The second bit of evidence comes from the subsidized "medium-term investment-credit program." Those firms that have received

money at 12% annual interest under this program seem generally to have chosen a more sophisticated technology than their domestic competitors who are forced to pay the market rate of 24 to 36%. One of the three domestic firms using capital-intensive technology was financed under this program, while only three of the 20 domestic firms using intermediate technology and none of the firms using labor-intensive processes were employing this subsidized capital.

The state enterprises seem to be consistently more automated than their private counterparts. One of the domestic enterprises employing a capital-intensive process and not financed under the "medium-term investment-credit program" was state-owned. Two of the plants employing intermediate technology were state enterprises, while none of those with labor-intensive technology were owned by the government. The state enterprises may receive subsidized capital; Table 2 indicates that they face higher wage bills than their private competitors. Their choice of more sophisticated technology may be economically justified.

However, some of the typical statements of the managers of various enterprises raise questions about the simple model of the "economic man" for fully explaining the decisions that are being made.

1. After noting that machines in the process of being scrapped were capable of producing a high-quality product, one foreign manager explained the replacement of the intermediate equipment with sophisticated equipment as follows: "You have to modernize to stay ahead of the competition." This statement was made in spite of the facts that there was a ban on the import of the product and that there were no other firms manufacturing the product locally. When asked what he was going to do with the old equipment, he explained that he was going to cut it up and scrap it. He would not sell it because "some of these Indonesians can get any old equipment running."

2. Another manufacturer who was employing young girls to attach labels by hand to his products explained that he was ordering a machine to replace them. Asked whether it was cheaper to attach them by machine, he explained that he did not know, but the girls were a lot of trouble: "They just cause management problems."

3. The manager of a plant with both an automatic and a semi-automatic line explained that he was converting the semi-automatic to fully automatic as soon as possible. He wanted to produce a "high-quality product." The output of both lines was already meeting the standards of the foreign licensor and was considered among the best in Indonesia by the firm's competitors. It was not clear that further automation would improve the quality in a way that consumers would notice.

The Investment to Replace a Worker

One way of determining whether managers are behaving as classical economic men is to calculate the incremental investment made per worker saved in one level of technology compared to the next lower level.

In the choice between the labor-intensive processes and the intermediate level, the model of the economic man appears to be of some explaining the choice of technology. Unfortunately, only the cigarette and soft-drink bottling industries could be analyzed for this step. The incremental investment for machine rolling of cigarettes, compared to hand rolling, was between $50 and $120 per worker saved. For soft-drink bottling, the additional investment for semi-automatic bottling compared to hand bottling was on the order of $833 per worker saved. The wages paid out to cigarette rollers run on the order of $100 per year. Thus, even with the higher investment figure of $120 per worker, a capital cost of 36%, and a maintenance or depreciation cost of 10% per year, the annual capital cost of saving a worker is only about $55. These figures suggest that hand rolling cigarettes continues because of the cost of capital, and also because of a differentiated excise tax that favors hand-rolled cigarettes, or because the consumer prefers the hand-rolled version.

On the other hand, semi-automatic bottling may well be a poor investment for firms that must pay 36% for their capital. The annual capital and maintenance costs would be about $383, considerably above the wage rates in Indonesia. Note, though, that a foreign firm, with an 8% interest rate and the same 10% maintenance cost, would face an annual capital cost of only $150, less than the annual cost of an unskilled worker in a foreign-owned plant. It is thus perhaps not surprising that hand bottling was done by domestic producers only. Semi-automatic equipment was operated by both foreign and domestic-owned enterprises.

In the case of the choice between the intermediate technology and the capital-intensive level, the findings are rather different. Calculations could be made for critical processes in five of the six industries. The average investment per worker saved was $6,986; the range was from $2,000 to $21,500. If the foreigner is able to raise capital abroad for 8%, and the replacement and maintenance requirements amount to 10% per year (or a 10-year life for the equipment), the annual wage that would have to be saved by an economic man would, for the average $6,986 investment, have to exceed $1,260 per year. The actual annual cash wage for employees of foreign firms averaged about $225. Even with a high cost for social expenses, it is unlikely that the real costs of a worker could approach $1,260 in Indonesia, nor is it likely that wages will reach that level in the foreseeable future. At the low end,

for an investment of $2,000 per worker the 18% capital costs amount to $360 per year. It is possible that the wages plus social costs of an employee for the foreign-owned plant could reach this level, but in only two industries was the investment below $3,500.

In spite of the fact that the capital costs involved in the capital-intensive technology generally far exceeded any possible wage savings, such investments were frequent and were being contemplated by many firms now using less automated techniques. The simple calculations suggest that these decisions did not make sense from the point of view of an economic man who wants to minimize costs.

Other Economic Factors

Three more complicated economic justifications for capital-intensity should be disposed of before the model of the economic man is pushed to the back seat: (1) The costs of developing more labor-intensive techniques may exceed the benefits of using known technology for the foreign firm; (2) the quality of output may not be sufficiently high or consistent with the intermediate technology; and (3) the intermediate technology may waste raw materials to an extent that their costs outweigh the benefits of the net savings on capital and labor. These themes did not, however, seem to go very far in explaining what was observed in the light manufacturing plants included in this study.

Where the intermediate technology has to be developed from scratch, or even has to be copied from others, the development costs may well outweigh the benefits to be derived from lower operating costs. One of the plants visited had attempted to introduce a new technology. After large expenditures on engineering and construction, the manager found himself with machines that did not function, and unexpected expenditures on modifications were already under way. In general, however, the managers of the plants included in this study of light manufacturing were well aware of and understood the intermediate alternative. In fact, many of the foreign firms had taken over a going enterprise as a joint venture, or had been given back a plant that had been nationalized under the Sukarno regime. In most such cases, the plant was already operating with an intermediate technology. However, in spite of the economics and knowledge of alternatives, the firms had already converted, or were in the process of converting, the plant to a more capital-intensive technology. Ignorance or cost of developing intermediate technologies was not the problem.

The quality issue is a difficult one. Engineering standards and consumer standards of quality do not always seem to agree. Quality was frequently mentioned as a reason for increased automation. However, several facts point to the conclusion that the supposed quality

differences were either not real or else were not perceived by the consumer as being real. In one industry, product test data from engineering tests were available from three firms, covering the output of competitors. The products that ranked highest in level of quality and lowest in variance from this level came from manufacturers whose processes extended down into the range of intermediate technology. In other industries, I asked firms to rate the quality of competing products and compared their responses. Again, the highest agreed rankings extended well into the range of intermediate technology.

In the case of cigarettes, a rather special industry in Indonesia, the engineering standard of quality seemed to conflict directly with the preferences of a sector of the purchasers. Machine-rolled kretek cigarettes (kreteks have a special flavor, due to inclusion of cloves) were having a difficult time taking a share of the market from the hand-rolled ones. The even-burning, crackle-free characteristics of the machine-rolled seemed to be less liked by the kretek smoker than the uneven, noisy, hand-rolled variety. Machines had not been developed to reproduce the familiar irregular, flared shape of the hand-rolled variety, which seemed to be more popular with the consumer.

The labor-intensive techniques did generally result in a product that was inferior, at least by engineering standards, to that of the more capital-intensive technologies. The hand-bottled soft drinks were, for example, probably not overly hygienic. Foreign matter could easily be introduced into the bottles by accident. And flies swarmed around the ingredients before they were hand-mixed. The flashlight batteries made by the labor-intensive techniques were more subject to leakage than were the others. However, the intermediate technologies did seem capable of turning out products of a quality that was consistently as good as that of the capital-intensive techniques.

Contrary to expectations, the saving of raw material was never mentioned by the firms that were interviewed as a reason for choosing automated production processes; in fact, it appeared occasionally as a reason for not automating. The automatic looms in the bag-making plants produced more rejects than did the semi-automatic. Simple manual cutters got more sandal soles out of a piece of foam plastic than did the automatic, ganged ones. And so on. Even these somewhat more sophisticated versions of the model of the economic man seem insufficient to account for the actual choices of technology. One must look for other explanations.

Oligopoly and Capital Intensity

One impression reinforced in the interviews was that the Indonesian entrepreneur wanted as much as his foreign counterpart to have an

automated plant. The suggestion was that somehow the foreign firm was in a position to fulfill this desire in more cases than was the domestic investor.

In fact, a better explanation than the nationality of firms that had chosen capital-intensive techniques seemed to lie in the degree of monopolistic advantage that the firm was able to exercise. The monopolistic position of such firms was evidenced by several factors. All but one of the foreign firms interviewed were using international trade names. The one exception had been operating in Indonesia for more than thirty years; it had developed brands that it did not use in other countries but which were thought by most consumers to be international. These brand names had given these foreign firms a position such that price was not the basis of competition. Of the three domestic firms using advanced technology, two had monopolistic positions: one was using an international trade name under license; the other was a state enterprise. In the intermediate-technology category there were only two domestic firms using international trade names. Both plants were noticeably more automated than the other domestic firms in the same industry.

Price serves as another indicator of monopoly position. The average price of the product of the capital-intensive plants was far higher than that of the intermediate level in all cases for which data were available (Table 3). Although the firms with capital-intensive technology all produce high-quality products, these products do not appear to rank higher in level of physical quality or consistency than those of the best of their

Table 3. Approximate Average Retail Price of Similar Product in Rupiahs

Technology	Plastic Sandals[1]	Cigarettes[2]	Soft Drinks[3]	Bicycle Tires[4]	Flashlight Batteries[5]
Capital-intensive	120	78	63	470	55
Intermediate	60	60	36	350	40

[1] One-piece sandals, per pair.

[2] The most popular brand, for each plant, per package of 20, white cigarettes only (excluding kreteks).

[3] For the contents of a bottle, adjusted to reflect volume.

[4] Wholesale.

[5] Size "D" (UM-1).

competitors who do not have international trade names. Their prices, though, are higher.

A further hint that monopolistic advantage, not "foreign-ness," underlies capital intensity is given by the cases of foreign firms outside the industries studied systematically. In these cases, my impression was that where trade names were not important, firms appeared to employ a much more labor-intensive technology than they used at home.

Reduction of risks. There appear to be a number of factors that drive firms toward more capital-intensive techniques than would be suggested by the simple economic models. In many cases the managers appear to want to respond to certain elements of risk and uncertainty. Capital-intensive plants seem in some instances to serve an insurance role. And some managers seem to be driven not only by simple economic objectives but also by objectives that could, perhaps, be best described as those of an "engineering man." But the ability of a manager to pay the cost of insurance against risk and uncertainty, or to let the engineering objectives have their play, is much greater for the firm that has a monopolistic position than for the one that faces severe price competition.

There are at least two kinds of insurance coverage that a capital-intensive plant might offer but the labor-intensive plant does not: the capital-intensive plant may allow the manager to respond more quickly to unexpected fluctuations in demand or to levels that are different from that for which the plant was designed; and the capital-intensive plant may be perceived as allowing the manager to reduce the risks of facing future liquidity crises.

Consider the problem of an entrepreneur who confronts a market for which the level of sales is likely to vary considerably. If the technology that minimizes costs is one that makes it difficult to adjust plant output to levels other than the optimal design output, the entrepreneur may decide not to adopt it; he may instead adopt a technology that allows for easy adjustment of output, even though it may entail a higher unit cost of production. In many cases, the more capital-intensive techniques are more readily adjusted to different levels of demand. Confronted with sporadic and unpredicted increases in demand, the manager can more easily run an added shift in an automated plant than he can in a labor-intensive plant where large numbers of additional workers will have to be recruited and trained. With brief contractions of demand, automated plants can be adjusted by running the machines more slowly, or by keeping fewer workers idle than would be the case in labor-intensive plants. Layoffs are expensive or difficult in a country such as Indonesia, where the labor laws discourage the practice.

If the insurance against errors in demand projections is attractive, perhaps the firms facing price competition should behave as the monopolists do. However, an entrepreneur faced with keen price competition is worried that his competitors may not saddle themselves with the insurance premiums in the form of higher production costs. In that case, the insured firm faces a lopsided loss-gain situation. If the original market forecasts turn out to be correct, the insured firm may be driven out of business by those not having to bear the insurance costs. At worst, the uninsured firm may miss some opportunities to profit from a quick expansion of its output. Its response, therefore, may be not to pay the insurance but to train a work force capable of producing at a level on the low side of its projected sales. On the other hand, the firm with a monopoly rent that derives from its inelastic demand curve may be able to afford the insurance. It can bear the higher production costs at the expected demand level, and supply a larger market or contract easily. And when the monopolistic firm is vertically integrated, the gains in being able to respond to an unanticipated increase in demand may be larger than is indicated by the profits of the operation under consideration.

The second kind of insurance that a more capital-intensive plant may offer is a reduction in the chances of a liquidity crisis. Managers responding to this kind of issue claimed that capital-intensive plants were "cheaper in the long run," a view which is at least partly a result of the imperfections in capital markets. Consider the possibility that a firm, confronted with monopolistic profits for a few years, fears the possibility that price competition may become so severe in the future that prices will fall close to marginal costs. Prices may actually fall to the point where they approach the marginal costs of a capital-intensive firm. The entrepreneur in Indonesia is constantly reminded of this possibility by some plants that had been closed as a result of intense price competition.

Faced with this possibility, the businessman could behave in one of at least two ways. He could build a labor-intensive plant with minimum costs and invest the incremental cash resulting from the savings during the period of relatively high prices in assets that would yield a return. If prices fell below his marginal costs later, he could close the plant, and still have an income from the assets that he obtained as a result of his lower costs during the period of high prices. But such an entrepreneur may doubt the reliability of his income from these outside investments, and in any case he is reluctant either to withdraw from his basic business or to remain in a business with a cash deficit that would have to be subsidized.

An alternative strategy would be to borrow to build a more capital-intensive plant at the beginning, pay off the loan during the period of high profits, and stay in the same business during the competitive period

as long as prices remain above his low marginal costs. This strategy generally appears much more attractive than that of minimizing costs. If intense price competition becomes a reality, the entrepreneur can stay in the same business without having to make up a cash deficit. And he can avoid the risk of having to invest assets in the capital market to cover later losses. Although the second strategy appeared to be more attractive to most Indonesian businessmen, the only ones who could follow it were generally those who held a sufficiently monopolistic position so that they could bear the heavier burden of financing for the capital-intensive plant until a loan could be repaid.

Engineering Objectives. The drive toward capital-intensive technology seems also to be a response to some objectives of the "engineering man." These are:

1. Reducing operational problems to those of managing machines rather than people.

2. Producing the highest quality possible.

3. Using sophisticated machinery that is attractive to the engineer's "aesthetics."

Reducing management problems could be viewed as an economic objective if management that is freed from problems associated with people could be devoted to other money-making activities with a higher return. However, there is no reason to expect the opportunity costs of a manager of plants in an oligopolistic position to be higher than those of plants in a more competitive market. The drive appears to be only partly a response to economic opportunity costs for his time, and more a preference for dealing with mechanical rather than human problems. Similarly, the production of a high-quality product could be viewed as an economic objective so long as quality increases the sale sufficiently to offset the higher production costs. But the concept of quality appeared to go far beyond that which had a meaning to the customer. And, although variances in quality would be a major problem in the very labor-intensive technologies, it did not seem to be an issue with the intermediate techniques.

It should not come as a surprise that engineering objectives play a role in the choice of technology. After all, most plants are designed by engineers. And that engineering objectives should sometimes depart from economic objectives should also not be surprising: engineers have a training that may instill in them noneconomic values, as it clearly does in many scientists. It is worth noting that few of the Indonesian firms did any calculations to investigate the appropriate technology to employ. Most of the foreign firms required some kind of feasibility calculation before new equipment was installed, but such studies did

not generally compare one technology to an alternative. The most common type of calculation was an engineering study in which the economic return was calculated only for the equipment proposed by the engineers with no comparison to alternatives. (In one case the calculations were done in the United States by a feasibility team made up of engineers who had never visited Indonesia.)

Constraints on Automation. If a firm is forced to compete on a price basis, economics provides a brake on the degree to which management can allow the engineering objectives to override the economic ones and a limit on the ability of a firm to use capital-intensive technology to insure against risk and uncertainty. Our research indicated that there are other brakes as well. The principal restraint for the firms with inelastic demand seemed to be the problem of maintaining and operating advanced equipment in a developing country. In fact, one domestic firm had installed very sophisticated machinery, but was gradually disconnecting the automatic controls as they broke down. And most of the complaints about the quality of Indonesian labor came out of the plants with the most capital-intensive technology. Maintenance and operation of the sophisticated equipment were requiring scarce skills.

The labor laws appeared to provide some brake for firms already in operation. A few managers explained that they had firm plans to automate, but could not do so immediately because they were not allowed by the government to release the workers made redundant. As soon as natural attrition of workers enabled them to do so, they would proceed to a more sophisticated technology.

And for some of the very labor-intensive firms, the inability to raise capital at any price seemed to act as a brake on moving to intermediate technology. Some were unable to borrow from the state banks and did not have the contacts to raise money on the quasi-legal private money market. What from the private economic view looked like an attractive movement up the scale of technology was constrained by the unavailability of the required capital at almost any price.

Conclusions

This study has only begun to probe the complex factors that influence the manager in his choice of technologies. The simple combination of production functions and factor costs is clearly inadequate to the task. A surprisingly wide range of technology was found to exist within the same industry and country. The capital-intensive techniques were generally associated with foreign investors. However, they seem to be more closely associated with investors who had some monopolistic position. Foreigners happened to be in such a position more frequently

than domestic investors, but the drive toward capital-intensive plants seemed to be similar among both foreign and domestic managers.

The managers' choice of technology appears to be influenced by two objectives which, in low-wage countries, are generally conflicting. The first objective, that of the "economic man," is to minimize costs. This leads to a relatively labor-intensive production process. On the other hand, the objective of the "engineering man" tends to lead toward more sophisticated, automated technology. Where price competition is the rule, the objectives of the economic man seem to override those of the engineering man. But when the firm has a monopolistic advantage, there is less pressure on the firm to minimize costs to survive; the goals of the engineering man are allowed to move the firm to a level of technology that is more advanced than that which the economic man would choose. In more advanced countries, however, there may be little conflict between the economic and the engineering objectives.

[Extracted from "The Economic Man and the Engineering Man: Choice of Technology in a Low-Wage Country," The Choice of Technology in Developing Countries (some cautionary tales), by C. Peter Timmer, John Woodward Thomas, Louis T. Wells, Jr., and David Morowitz. Harvard Studies in International Affairs, Number 32. Cambridge, Mass., Center for International Affairs, 1975, Copyright © the President and Fellows of Harvard College. (Note: copies may be obtained from the Center for International Affairs, 6 Divinity Ave., Cambridge, Mass. 02138, U.S.A., price $3.95.) Another version of this article appeared in Public Policy, Vol. XXI No. 3, Summer 1973.]

Factor Proportions for Manufacturing in Less Developed Countries: A Survey of the Evidence

Lawrence J. White

[In the debate over the desirability of more labor-intensive technologies for use in industry in low-wage countries, an important question is whether efficient alternatives to the technologies used in high-wage countries are actually available. This extract reviews a range of evidence on the subject, concluding that efficient alternatives can very often be found.]

The question of appropriate factor proportions in LDCs has emerged as one of the most important development problems of the 1970s. High and rising rates of unemployment in urban areas pose major political and economic problems for less developed countries (LDCs). Simultaneously, employment in manufacturing is frequently growing far more slowly than the growth of manufacturing output. The high capital intensity of LDC manufacturing is frequently cited as the oause of these phenomena. Capital-labor ratios for new or proposed industrial projects in LDCs are frequently $15,000 or more per worker, and facilities in the petrochemical industry can run as high as $200,000 per worker. The following questions must be asked about these high capital-labor ratios in LDC manufacturing: Are they necessary? Or are there efficient alternatives which use less capital per worker and could therefore be more appropriate for LDCs? What evidence is available on this point? This paper will provide a non-technical review of the available evidence that can shed light on these questions. A dozen surveys or summaries that deal with the problem of technology for LDCs have appeared since 1970 [references to these and other works are found in the original paper]. But the emphasis of each is somewhat different, and none has focused primarily on the <u>evidence</u> concerning

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factor proportions and appropriate technologies in manufacturing, which is the major task of this paper.

It may be useful to illustrate the direct effect of high capital-labor ratios for new manufacturing projects. Let us suppose that an LDC has a per capita income of $500. The country has a current population of 1,000 (for easy computation) and a labor force of 400 growing at 3% per year, so that 12 new workers are added. Current GNP is $500,000. If the country is investing 18% of GNP, perhaps 12% - i. e., $60,000 - would be available for net new investment (the remainder covering the replacement of older, worn-out capital.) Average capital per worker in the entire economy might be $1,000.

Now suppose that new manufacturing projects require a high capital labor ratio -- say, $15,000 per worker. The available investment funds would only stretch as far as equipping four new workers; i. e., only one-third of the new workers would be equipped; the remainder would have no capital with which they could work and presumably would be unemployed. If we were to equip the new workers at the prevailing $1,000 capital per worker level, we would have funds remaining for investment; these could provide only three and one-half workers with the capital intensive manufacturing jobs. Thus, if unduly capital-intensive manufacturing processes are chosen, not only will capital deepening fail to take place among almost all the existing labor force, but a small industrial labor elite will develop. However, if there were efficient technological alternatives with lower capital/worker ratios, so that the new investment could be more widely spread over the entire labor force, overall output and income would be higher than with the capital-intensive methods because of the diminishing marginal productivity of capital when it is all concentrated on a few workers. Thus, though the high productivity from high capital-labor ratios is the eventual goal of economic development the efficient path to this goal is a gradual capital deepening for all rather than sharp capital deepening for a few.

High capital-labor ratios, then, clearly pose serious economic and social problems. But are there efficient alternatives, or are the high ratios a problem that LDCs must live with until alternative technologies are devised?

Alternative Factor Proportions: The Evidence

The belief that capital intensive manufacturing processes similar to those found in developed countries are the correct ones for LDCs appears to have been very strong in the 1950s and 1960s, especially by engineers but also by a number of economists. The major argument in favor of them was that they were simply more efficient than more labor intensive alternatives: the latter, it was claimed, would

always use more labor and more capital per unit of output than would the process with the high capital-labor ratio. Thus, though alternatives might exist in a technical sense, they would always be found to be inferior. This could also be characterized as a belief in fixed proportions (as opposed to factor substitutability), since the efficient factor combination is fixed at the proportions found in developed countries. The identification of efficiency with "productivity" (i. e., labor productivity) by many international study groups and productivity missions in the 1950s and 1960s has contributed to this view. This confusion of labor productivity with efficiency meant that high capital-labor ratios would be associated with efficiency.

Some writers, like Jack Baranson (1969, 1972) and W. Paul Strassman, (1968), have argued that high levels of mechanization are necessary to ensure high levels of quality (e. g., in machined products), or to substitute for managerial skills in organizing and supervising workers -- skills which are even in shorter supply in most LDCs than is capital (Albert O. Hirschman, 1958). A completely different line of argument favoring capital intensive technologies has rested on alleged saving and reinvestment rates by different economic groups. As argued by Galenson and Leibenstein, capital intensive technologies would mean higher returns to capital, and capital owners have higher saving and re-investment rates than workers. Hence, even where efficient labor intensive methods are available, capital intensive methods should be chosen because reinvestment would be greater and the pace of industrialization would proceed faster. This argument clearly hinges on empirical evidence concerning savings rates by different groups.

We now turn to the evidence. In one sense, it is easy to provide evidence that developed country capital-labor ratios are not the only alternatives available. A glance at any LDC industrial census with capital data will reveal capital-labor ratios that are usually a third of those in the U. S., and this despite the prevalence of LDC rates of capacity utilization below that found in the U. S. (i. e., LDC capital-labor ratios would be still lower with better capacity utilization). But the believers in the superior efficiency of capital intensive methods would probably not be convinced by this kind of evidence. They might well argue that the LDC methods are inefficient (antiquated, improperly conceived), and that protectionist policies in LDCs buffer these inefficient production units from more efficient competition. They might also argue that the LDC methods are efficient only for the small size of LDC markets, and that larger volumes could be produced more efficiently with more capital intensive methods - an argument to which we shall return below. Accordingly, a more systematic investigation than just a casual perusal of LDC industrial censuses is needed. We shall discuss six different kinds of evidence.

Econometric investigations of factor substitution. There have been a large number of efforts to use LDC data, usually from industrial censuses, to try to measure the degree of substitutability between capital and labor. All such efforts involve trying to measure the elasticity of substitution (i. e., the percentage change in the capital-labor ratio in response to a change in the factor-price ratio) in a constant-elasticity-of-substitution (CES) production function involving capital and labor. An indirect method is used: if the logarithm of output per worker is regressed against the logarithm of the wage, the coefficient on the latter variable is an estimate of the elasticity of substitution. Most studies use this form. A few regress the output-capital ratio against the return to capital, or the capital-labor ratio against the wage alone, or the ratio of the wage to the return to capital (all in logarithms) to provide alternative estimates. These estimates have been made for the whole of manufacturing in single countries and for individual sectors within manufacturing, for both time series and cross-sections, and for sectors across different countries. There have been some 53 empirical studies, largely in the 1970s, covering a wide variety of countries.

It is difficult to characterize the results of these studies. The estimates of the elasticity of substitution are, with only a few exceptions, positive, indicating (if one accepts the methodology as valid) that efficient factor substitutability is possible and that the fixed proportions view of the world is incorrect. The estimates tend to clump between 0. 5 and 1. 2, but some studies find values appreciably above and below these values. Cross-section studies tend to find higher elasticities than do time series studies. An elasticity above 1. 0 implies that not only will a fall in wages induce an increase in employment (as labor is substituted for capital) but also that labor's share of income will increase.

The problems are that: the data are bad; the CES form may not be the correct one; the time series studies may not include lags properly; the profit maximization assumption may not be a good one; the assumption of competitive markets is surely not true; the cross-country studies may not use the correct exchange rates; the cross-section observations may not be using comparable industries; the level of capacity utilization is usually not held constant; all labor and all capital are assumed to be uniform and to be the only factors of production; and so on. It is easy to be skeptical of the results. Howard Pack (1972), for example, has argued that rather than showing a causality between substitution away from labor and wages, the regressions may be showing a reverse causality between wages and increasing productivity. Cross section regressions may be capturing a similar effect, as could the regressions using capital-labor ratios. In any case, there is little consistency among the cross section studies in their rankings of common industries by estimated elasticity of

substitution. If one already believes that capital-labor ratios are efficiently flexible and that entrepreneurs do respond to factor price incentives, then the results of regression equations do provide support for this view. But if one believes that efficient factor proportions are more or less fixed, then the regressions may not support the claim of substitutability.

Engineering or process analysis studies. In these kinds of studies, researchers investigate individual manufacturing processes or individual products. The investigators usually use engineering or other technical information to determine the inputs necessary to produce a given volume of products or to process a given volume of manufactured items. A principal part of the investigation is to see if there are alternative means of producing that same volume; i. e., if more workers and fewer machines (or, more usually, simpler and cheaper machines) can produce the same volume as fewer workers and more machines. Twenty-two such studies can be cited.

An important result does emerge from these studies: factor substitutability does seem to be quite possible, and the differences in factor ratios can be quite substantial. Timmer's (1975) study of rice milling and marketing systems found four efficient alternatives, of which the most capital intensive required $65,000 investment per worker and the most labor intensive $700 per worker. The ECLA study of cotton textiles reported by UNIDO (1969) showed a choice of efficient techniques ranging from $6,600 investment per worker to $21,500 investment per worker; Pack's (1974) study argues that the lower limit is closer to $1,000 per worker. Further, Pack (1974) was able to relate the efficient factor combinations observed in operation to the wage rates and returns on capital, to calculate elasticities of substitution. Of six industries observed all had positive elasticities of substitution, and five were above 1.0. In virtually all these cases, the labor intensive or intermediate alternatives are economically superior at realistic opportunity-cost wage and interest rates for LDCs. Thus LDCs do not appear to be limited to current developed-country capital intensive methods.

There are some unanswered questions, however. First, the question of economies of scale: some studies find appreciable economies of scale in metal machining processes and in cement block making, and that capital intensive methods are necessary to capture these economies. At low volumes there are efficient labor intensive alternatives, but as volumes increase the input levels grow more slowly, so that unit costs fall; and this happens to a greater degree for capital intensive processes. At very high volumes the capital intensive processes dominate, so that at any wage or interest rate it makes economic sense to choose the capital intensive processes. The lower the wage, however, the higher the volume at which it makes sense to switch from the labor intensive to the capital intensive processes.

Economies of scale are particularly important for certain manufacturing processes like metal finishing, and in flow processes which involve liquids, pipes, and containers, like petroleum refining and chemical production. The importance of setting-up costs for a production run, or the surface area and volume relationship of containers, dominate here. For other types of manufacturing process, and certainly in materials movement between processes or into storage, the scale effects seem to be much less important. Clearly, much more needs to be specified in the relationship between scale and factor substitutability in order to distinguish processes in which capital intensity is genuinely cost-saving with particular factor prices from those where it is not and to distinguish what combinations of these are possible in the same operation.

For a product that does embody significant scale effects, LDCs face a dilemma. The small-market LDC can achieve appropriate factor proportions but has high unit costs (although it would have still higher unit costs if it switched to the capital intensive method), while the large-market LDC can obtain lower unit costs but with high capital intensity. Only research leading to new technologies that would decrease the importance of scale effects or have them apply equally to labor intensive methods offers a way out of this dilemma.

A second open question in these studies is the problem of quality. Are capital intensive processes necessary to ensure high quality? Frances Stewart (1975) argues that this is the dase for cement blocks, while other studies claim that quality need not be affected by technique or neglect to mention the problem. Levels of desirable quality, of course, vary with the market requirements. As noted above, other observers argue that, particularly in metal finishing processes, machines can substitute for skilled labor and foreman supervision for ensuring a high, uniform quality standard. Unfortunately, there is only one piece of quantitative evidence on this point. Christopher Clague's (1970) study showed that the overall efficiency of Peruvian industries relative to that of comparable U. S. industries increased as capital intensity increased: machine paced processes seem to offer less latitude for labor inefficiency. The engineering and process studies have not thus far been able to quantify this, and so it must remain, with the exception of Clague's study, largely an open question. It should be noted that high levels of mechanization will require the repair skills necessary to maintain the complex modern machinery, and these are usually as scarce in LDCs as the management skills that the machines are supposed to replace. Repair skills to handle simpler machinery, however, are ususally in greater supply.

In all, the engineering and process analysis studies do provide powerful demonstrations of the feasibility of labor intensive methods and are probably more convincing than the econometric studies on substitutability. But there are still the difficult questions of scale, quality, and skill substitution that merit further study.

Anecdotal evidence. Under this category we group studies that report examples of labor-capital substitution but do not offer precisely quantified estimates of efficient combination in the way that the engineering studies do. These reports can nevertheless offer useful insights in the production processes.

During Japan's early industrialization, for example, when wages were comparatively low, machinery in textiles and other industries were run faster and with extra shifts; this meant more frequent halts for repair, but repair was a labor intensive activity. The overall effect was greater labor intensity and greater efficiency in the use of all resources. Thus, even for processes in which mechanization was necessary for quality reasons, double and triple shifts greatly decreased the overall capital-labor ratio. Much use was made of older, used equipment from the West. Raw material inputs were modified so that more labor intensive processes could be used. Gustav Ranis reports that similar capital-stretching, labor intensive techniques are now being used in Korea and Taiwan in textiles, electronics, woodworking, and other industries. He further points out that even for products in which there may be technical rigidity in some main production processes, there are always peripheral processes like materials handling and packaging which can be done efficiently with labor intensive methods. Similarly, Howard Pack (1972; 1976) reports examples of labor-capital substitution in consumer goods manufacturing in Kenya, but also notes quality problems: for example, human handling of fruit inputs into food manufacturing may lead to higher rates of spoilage or breakage.

A number of other reports describe LDC production processes that are more labor intensive than those of developed countries. But are the adaptations efficient? In virtually all cases, the researchers state that greater labor intensity has taken place in response to the lower volumes and/or the lower wages of the LDCs. This kind of response does tend to support the notion that these are efficient adaptations. The anecdotal evidence then, points in the same direction as the earlier evidence: greater labor intensity is not only feasible but is in fact occurring in some LDCs. It does, however, seem to be closely tied to good management.

Big firms versus small firms. It is widely acknowledged that small firms are more labor intensive than large firms. But are the small firms more efficient? The output-capital ratio of the small firms compared to the large firms is critical to deciding whether capital can be saved by expansion of small firm production. The evidence is mixed: Gustav Ranis (1962) finds that small firms in Pakistan had higher capital-output ratios than large firms; B. V. Mehta (1969) finds the same to be true for India, as does Keith Marsden (1969) for a number of countries. But P. N. Dhar and H. R. Lydall (1961) find the opposite to be true for India, as does J. C. Sandesara (1966; 1969). [This subject is also ad-

dressed in the next article.]

Used machinery. Second-hand machinery from high wage countries is frequently recommended as a way for LDCs to reduce capital-labor ratios. A high wage economy will find it economically rational to replace machinery much sooner than would a low wage economy when new and more labor-saving models are developed, and when capital is cheaper and more abundant. Low wage LDCs should find worthwhile the purchase of used machines that developed countries find marginal. If there is an active market in used machinery in the developed country, the price of the used machine would have to fall by enough for buyers in that country to find it worthwhile to consider the used machine as an economic alternative to the new machine. At such a price an LDC buyer will surely find the machine more worthwhile, even with transportation cost added, because of the latter's lower wage costs. The counter arguments are that good markets in used machines do not exist, that used machines are a very risky proposition, that spare parts may not be available, or that the machinery is so technologically obsolete that the use of the machines is inefficient compared to new machines.

What is the evidence? First, it should be noted that organized markets in used machinery are present in the developed countries. Brokers, catalogues, and trade associations of used machinery dealers do exist. Second, over half a dozen studies supply a fair amount of evidence that used machinery is employed efficiently in LDCs. C. Cooper and R. Kaplinsky (1975) do stress the risk element in buying used machines; it takes special skills to be able to tell which ones are the "lemons," and manufacturers' warranties will no longer apply. Indeed, all of the studies stress the need for good management and engineering skills as a necessary adjunct to the proper choosing, adaptation, and use of second hand machinery.

There is a particular advantage which could be gained by buying second hand motor vehicles. There are large stocks of used cars and trucks constantly available for sale in the U.S. and Europe. It is well known that, especially for cars, prices depreciate faster than pure utilitarian usage considerations would dictate. Spare parts are usually quite available, and technological change since World War II has been quite slow. It would appear that many LDCs would do well to forego importing new vehicles or attempting the domestic production of these vehicles and instead to import large quantities of used vehicles. Repair requirements would be greater for a fleet of used vehicles, but these skills are present in most LDCs. Parts, if not available, could be manufactured locally. Both domestic and foreign exchange resources would be saved for better uses. In sum, the evidence on used machinery does show the possibilities of lower capital-labor ratios.

Multinational Corporations (MNCs). The MNCs are frequently pictured as the special villains of the appropriate technology effort. They

are, so the argument goes (C. Vaitsos, 1975; Paul Streeten, 1973), tied to their capital intensive technology in the developed countries. That is what they are familiar with; that is what their product quality and trademark image is frequently based on. It is frequently too risky and costly for them to try to change their technolgy for LDC conditions. They ignore the possibilities of using local raw materials inputs. And, even if they were considering adaptations, they frequently pay higher wages than do locally-owned firms and they can obtain their capital abroad at cheaper rates, so they would have less incentive to adapt. The counter argument, presented by Howard Pack (1972; 1976), is that good management appears to be necessary to recognize and utilize the possibilities of labor-capital substitution. And the MNCs frequently have the best management around; even if they pay higher wages than local firms, their wages are still considerably lower than those in the home country so that there is a strong incentive for adaptation.

What is the evidence? Here we must be very careful in evaluating it. A number of interview and questionnaire surveys of MNCs have concluded that only a modest amount of technological adaptation has taken place, and that has been mostly in response to lower volumes, not local factor costs. This evidence has been widely cited by those who see the MNCs as villains. But there is an interesting paragraph in Gerard K. Boon (1975) describing an interview at an engine plant owned by an MNC in Mexico. At the beginning of the interview, the management assures Boon that the Mexican plant uses exactly the same technology as that used in the parent plant in the developed country. But as the interview proceeds and Boon tours the factory, it becomes clear that in many respects the factor proportions are different. The main machinery processes are automated but second-hand equipment is used, and all of the packaging, handling, transporting and storing are done much more labor intensively. Perhaps interviewers get told what the interviewees think they wish to hear or what the interviewees wish to believe!

Contrary to these interview or mailed questionnaire surveys, it appears that any researcher who sticks his head into an MNC facility in an LDC and looks around is likely to find substantial adaptations of capital-labor ratios, particularly in auxiliary processes. More than a dozen studies find MNCs adapting to labor-intensive processes for export processes. Not all MNCs adapt: some of the MNCs in Paul Strassmann's sample (1968), for example, had not adapted their technology. But a higher fraction of the MNCs in this sample adapted their technology than did locally owned firms, and a higher fraction were using second-hand machinery.

It appears, then, that both locally controlled firms and MNCs can and do adapt their factor proportions. But which group is more likely to adopt the more labor-intensive methods? In examining comparative evidence, we cannot consider economy-wide comparisons: MNCs are

always more capital intensive than local firms since they do have a comparative advantage in capital intensive products. The critical question concerns comparisons within an industry in which both groups are present. Strassman, Pack, and the ILO mission to Kenya all find the MNCs to be more labor intensive; they explain this on good management grounds. But R. H. Mason (1970;1973) finds that for a group of matched pairs of firms, U. S. controlled firms tend to be somewhat more capital-intensive than locally owned Philippino or Colombian firms; and G. M. Radhu finds foreign firms to be more capital intensive than locally owned Pakistani firms. Benjamin H. Cohen (1973; 1975) finds no significant differences between foreign and Korean firms producing for export markets. The evidence is clearly mixed. While the MNCs may not be the heroes of appropriate technology, they appear to be far from the villains that many make them out to be.

Factor proportions and saving rates. An argument cited earlier in favor of capital intensive methods is that they would raise the income share of capital owners, who are supposed to have higher rates of saving and reinvestment than do workers; the pace of industrialization would thereby be quickened. This kind of argument, of course, presupposes that government taxation of labor incomes for saving purposes is not feasible. But, ignoring this, what do we know about savings rates?

The evidence reviewed by Raymond R. Mikesell and James E. Zinser (1973) does indicate that saving out of labor income is very low; the marginal propensity to save rises with income, and the saving rate out of profits is high. But if we turn to the savings rates of firms of different capital intensities, Gustav Ranis (1962) provides evidence that medium size (less capital intensive) firms have higher saving and reinvestment rates per unit of output than do large firms. V. Appavadharrlu (1974) argues that small firms in India have higher saving rates than large firms. firms.

This extract has summarized the available literature on the possibilities of labor-capital substitution in LDC manufacturing. Each section has presented one aspect of the evidence. By itself each section may not appear entirely convincing, but together they do paint a rather impressive picture. There do seem to be plenty of opportunities for more labor intensive methods to be used. But the ranges of choice are far from complete. It is the task of research and development to increase the range of choice.

[Extracted from Attachment C to Proposal for a Program in Appropriate Technology, pp. 1 - 36. Submitted by the U. S. Agency for International Development to the U. S. Congress, June 30, 1976.]

Policies to Encourage the Use of Intermediate Technology

Howard Pack

[Given that more labor-intensive technologies would be desirable in the industries of developing countries, how can this be brought about? This article argues that government policies which have fostered capital-intensity will need to be modified, and proposes some methods that could have this result.]

This paper has several purposes: to indicate the policies by which a government may alter the relative costs of capital and labor in industry; to indicate how much is known empirically about the efficacy of such changes; and finally, to consider how a program to undertake such changes can be pursued.

The focus on this kind of policy change for less developed countries (LDCs) assumes that, if factor prices were changed, then methods of production could be introduced which are more labor intensive than those currently in use, and which will be more profitable at the new factor prices than techniques currently in use. This assumption rests on the following research findings [see also preceding article].

In a large number of industries a product is producible with a considerable range of alternate ratios of capital to labor. Much of the potential substitution of labor for capital stems from use of labor intensive methods to transport material within the factory, to pack cartons, and store the final product - i. e., in peripheral activities. Evidence is accumulating that the core production process itself also offers efficient possibilities for using less expensive equipment, and more labor per unit of output. Adaption of existing equipment, for example by increasing the normal speed of operation, offers further opportu-

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nities to save capital and increase the relative use of labor. Finally, the extensive under-utilization of industrial capacity provides scope for raising effective labor/capital ratios by increased utilization. Some industries, however, seem to offer little possibility for altering the capital/labor ratio from that prevalent in advanced economies; these are typically activities in which most LDCs have no comparative advantage.

The Role of Factor Prices

Competitive Environment. The ratio of labor to capital costs is usually thought to play a decisive role in determining the ratio of capital to labor used in the production process. This role of relative factor prices, however, requires competition among producers to be effective. There is abundant anecdotal and some numerical evidence which suggests that factor prices have rather little effect in non-competitive environments. A monopolistic firm currently realizing a 30 percent return on its equity capital, though using an inappropriately high ratio of capital to labor, may have little incentive to search for more appropriate methods which may raise its return to 35 percent. If factor prices are to exert pressure toward adopting socially appropriate techniques, some kinds of competitive forces must be present. In some of the small markets in LDCs, such pressures may be best engendered by international competition rather than by a proliferation of large numbers of small domestic companies when none of these are likely to reach economically efficient sizes. In other cases, increased numbers of efficient small producers may be the best solution.

Factor Price "Distortions". It has become conventional to assert that labor costs in LDCs are "too high," capital costs "too low," and raw materials prices distorted, though not in one direction. What is the precise meaning of these statements?

The hiring of a worker entails the payment of a cash wage, and one or more of the following: payments in kind (housing), non-cash fringe benefits (social security), and in some countries such supplements as "thirteenth month" salary. The cost of hiring a worker is "too" high if the value of the cash wage and other benefits exceeds the income which the worker could command elsewhere, given his abilities, both inherited and obtained by education and on-the-job experience. It has long been noted that the typical employee in a modern enterprise, be it a factory, bank office, or government agency, earns considerably more than a worker in small scale artisan shops or in self-employment such as barbering, and certainly more than agricultural workers and small farmers. It is generally believed that the observed income differentials do not represent a reward for greater productive ability, but are artificially high and institutionally supported, reflecting government

minimum wage legislation, union bargaining success, and employer aversion to paying lower, more appropriate wages which typify other activities. There have been no studies measuring the extent to which such high wage incomes are the result of greater work-related skills; although recipients of high wages are often unskilled when initially hired, their productivity can increase by learning on the job. But even if some of the observed high wage structure is related to skills, it is likely that union pressure and government minimum wage legislation add to these differentials.

The statement that wages are too high thus refers to the norm of alternate income possibilities for a similarly skilled worker, either in the urban craft sector or in rural activities. It does not imply that these wages are excessive in comparison with those in developed countries, or that such workers are able to afford a luxurious living standard. But high wages accruing to the small group lucky enough to obtain modern sector jobs do imply that production will be undertaken with fewer workers than if wages were lower, thus condemning those not fortunate enough to obtain such jobs to a lower standard of living than would have been possible with a generally lower wage structure. Instead of a million workers employed in the modern sector, each receiving a wage of $500 per annum, 200,000 workers may receive a wage of $900, with the remaining workers earning $150 per annum.

The cost of plant and equipment reflects the purchase price of a factory building or machine, and the costs incurred in financing it. The cost of using plant or equipment is best viewed in terms of a firm's annual expenditure: depreciation of the initial acquisition cost; and a yearly financing charge incurred as the result of a decision to purchase the capital item. The purchase cost of equipment is too low in most LDCs in the sense that the net effect of government foreign trade policies is typically to artificially lower the amount of domestic currency which must be given up to pay for an imported machine. Most LDCs have engaged in a sustained import substitution program, one of whose characteristics is to maintain an overvalued exchange rate, i.e., the domestic currency buys too much foreign currency. This artificial cheapening of foreign goods may be offset by high tariffs on imported goods which compete with domestically produced goods. However, no tariff is imposed on imported equipment, in order to encourage domestic investment. Thus, LDC firms purchasing new equipment pay a lower price than would exist if governments did not discriminate between different types of imported goods. A low purchase price, of course, is reflected in low annual depreciation charges.

The second major cost is the financing charge. Financing of investments may originate either in bank loans or in funds from private sources. The interest charges paid by larger companies in the urban sector is too low as a result of governmentally imposed limitations on bank

rates of interest. At these low-ceiling levels of rates, the total demand for loanable funds exceeds the supply, and the existing supply is rationed among competing companies, none of whom are charged more than the legal maximum. Companies which are unsuccessful in this competition are forced to borrow in a private market in which the rates often are three or four times the official one. The financing charge for new equipment or buildings will clearly be greater for those (usually small) firms which cannot qualify for bank loans. When they are willing to borrow at these rates, this suggests that profitability in their industry is at least equal to this higher rate. Large firms, receiving as it were subsidized loans, pay too low an annual financing charge for the capital which they use.

Apart from low purchase prices and interest rates for many investors, numerous tax regulations further reduce the annual charge for using equipment. For example, investment credits and accelerated depreciation are likely to have adverse effects on the choice of production methods, particularly in view of the already high rates of return being earned by investors who hardly require additional incentives.

The cumulative effect of all these distortions in wages and the cost of capital has presumably been to bias the choice of individual firms toward unnecessarily capital intensive production methods. One indication of this is the discrepancy which has been observed between the growth of output and of employment in the industrial sector. Considering the continuing large flow of new equipment from industrialized countries to LDCs, some of this must be inappropriate given the high wage levels in the former countries for which the equipment is presumably appropriate.

To remove the incentives toward adoption of socially inappropriate equipment, the imperfections in factor markets must be reduced. The following policies would have this effect: 1) Removal of the minimum wage, particularly for new employees, or reducing it to the levels prevailing in the craft sector. 2) Undertaking policies to shift the supply curve of wage goods in order to reduce their price. 3) Limiting the growth of wages paid by the government sector, which often serve as a guidepost for private sector wages. 4) Curtailing the fringe benefits such as social security currently in force. 5) Allowing the official exchange rate to move down towards its equilibrium value and removing tariffs, administrative limits on imports and so on. Alternately, and less desirably, tariffs on imported capital goods could be introduced to raise their cost in domestic currency. 6) Removal of interest rate ceilings. 7) Elimination of tax incentives which reduce the cost of utilizing capital in production. 8) Elimination of the licensing of imported raw materials, a practice which has often been shown to discriminate against small labor intensive enterprises.

It would be difficult to construct a set of policy proposals which would generate more intense opposition among many of the most politically powerful groups who perceive the probability of substantial reductions in income. Highly paid, often unionized workers concentrated in urban areas would be adversely affected. The management of large companies currently enjoying subsidized equipment, low interest rates and access to raw materials would have to contemplate a reduction in windfall profits. Those who would benefit most, the workers and entrepreneurs in the craft and small scale sectors, while surely more numerous, are poorly organized and likely to be less politically active. It is easy to see why such alterations in factor prices, even where the potential overall benefits are understood by the government, may not be attractive to it.

A more immediate question is whether factor price changes will work. Changes in technique are most easily made when new production decisions are taken. Existing equipment usually has limited flexibility, not permitting a decrease in the capital/labor ratio. Will firms facing a changed economic environment actually react in the anticipated direction when expanding their capacity?

First, unless a reasonably competitive environment exists, the rates of return available in highly protected industries may be such that little effort is forthcoming to adjust factor proportions. Small increments to profit resulting from economizing on inputs may not be worth the effort as long as "reasonable" profitability can be maintained. Even assuming a desire to restore or augment profits, managerial time may better be spent cajoling a somewhat higher nominal protection rate for a firm's output, looser quotas on critical inputs, etc., than in adjusting factor proportions. Avenues to increased profitability other than improved productive efficiency must be closed if changes in factor prices are to provide the strongest possible impetus to an exploration of alternate techniques of production.

Secondly, it is possible that despite the objective existence of more labor intensive production methods, this knowledge is not widely diffused among entrepreneurs. Knowledge of appropriate techniques requires familiarity with a number of different kinds of basic production equipment, and with alternate methods for carrying out subsidiary operations such as intraplant movement of material. However, these alternatives are not likely to be advocated by the (large) company's engineer, by the equipment salesman, nor by government agencies.

Evidence on the Effects of Changes in Factor Prices.

There have been only a few conscious attempts by LDC governments to alter relative factor prices. The classic success stories of appropriate factor price policies associated with a sustained growth in

industrial employment are in South Korea, Taiwan and Singapore. In the first two, the interest rates charged by public and private banks were raised sharply and were maintained much closer to market levels than is usual in LDCs. In Singapore, real wages were held down for some time despite a growing demand for labor; while not precisely a change in price, this does represent a somewhat unusual policy. And there is no question that all three countries have demonstrated a highly successful record of industrial growth. The problem, however, is that of determining what effects are attributable to the factor price policies mentioned.

In Taiwan, interest rates were raised in the early 1950s and kept high through the 1960s. Industrial output grew rapidly, and the growth rate accelerated throughout this period; the increase in employment began more slowly in the 1950s but gradually accelerated to a high level by the late 1960s (Table1). Although production per employee continued to rise by 7 percent or more per year, it might be said that the maintenance of high interest rates led eventually to factor combinations which provided considerably more employment than would otherwise have occurred. But this would be very hard to prove, given all the other factors influencing these growth rates. Labor intensity also resulted from the export drive focussed on products in which Taiwan's low wages gave it a comparative advantage in world markets.

Table 1. Annual Compound Growth Rates in Industry, Taiwan and South Korea (percentages)

	1953-58		1958-63		1966-69	
	Output	Employment	Output	Employment	Output	Employment
Taiwan	9.0	1.9[b]	13.1	2.8	20.0	13.2
S. Korea	16.1[a]	5.6[b]	10.0	8.3	28.8	13.7

[a] 1954-58
[b] 1955-58

Source: U. N. Growth of World Industry, various issues.

Korean interest rates were raised only in 1965, so that a short run impact of that change might be easier to find. But the figures in Table I do not suggest a shift toward greater labor intensity in industrial growth following that date, since the growth of employment relative to that in production had been larger in the preceding period. The higher interest rates undoubtedly did much to produce the sharp acceleration of growth in both variables after 1965 by mobilizing savings [see Brown's article in Development Digest, October 1975, pp. 63-78]. And Korean industry,like that in Taiwan, appears to

be relatively labor intensive in its methods. But here, too, this resulted in part from a drive to export labor intensive products, and the contribution of high interest rates to factor proportions cannot be isolated.

In Singapore, the annual rates of growth from 1968 to 1971 were as follows: industrial output - 24.0%; industrial employment - 17.7%; real wages - 2.3%. Again, there were many influences at work, and the contribution of wage policy to employment growth may be stated in terms of logic but cannot be measured. In all three cases the merits of more appropriate factor pricing seem to be vindicated by the overall results, the more plausibly because these economies were relatively competitive internally along with their open trade policies. But the attribution of results to specific factor price policies remains ambiguous.

Effects of Differences in Factor Prices Facing Firms of Different Size

Given the difficulties in interpreting the classical cases of policy-induced changes in factor prices and the possibility that these may be in unusually-entrepreneur or skill-rich nations, are there other empirical bases on which to assess the potential benefits of moving towards a more rational factor price configuration? There is a rapidly accumulating body of evidence whose major implication is that differentials in factor prices faced by firms of different sizes have indeed led to alternate methods of production. The higher wages and the lower interest rates typically paid by large firms appear to have resulted in sharp variations in factor proportions among firms within the same industry in a given country. Such cross sectional evidence suggests that a change in factor-price ratios is likely to be effective if combined with competitive pressures in the output market.

A large number of empirical studies have examined differences which exist among firms of different size as measured by number of employees. Of particular interest is the increase in the capital-labor ratio as the size of firm increases for a given industry such as textiles or food processing. This pattern at least partly represents the increase in the use of equipment, tools, and mechanical conveyors in response to increasing wage levels in the larger firms, it being well documented that the wage per worker is highly correlated with firm size. The earliest demonstration of these now conventional findings appeared in analyses of Japanese manufacturing, and the results have been verified for almost all LDCs which have been investigated, the major exception being Taiwan. Table 2 presents fairly typical wage patterns by firm size for the entire manufacturing sector in Mexico in 1965 and Pakistan in 1960. Disaggregation by the two digit classification of industries reveals a similar pattern among firms with similar products.

Table 2. Average Wages and Capital/Labor Ratios by Size of Firm, Mexico and Pakistan

Mexico - 1965			Pakistan - 1960		
Firm Size (number of employees)	Wage Index[a]	Capital per Worker	Firm Size (number of employees	Wage Index[a]	Capital per Worker[c]
1-5	21	10.5	1-9	58	0.63
6-15	41	31.3	10-19	76	1.96
16-25	55	48.6	20-49	89	2.13
25-50	61	57.5	50-99	96	2.37
51-75	68	62.1	100 and over	100	2.92
76-100	70	63.8			
101-250	78	80.4			
251-500	88	96.2			
over 500	100	104.8			

[a]Index values with 100 for average wage in largest size group.

[b]In thousands of pesos.

[c]In thousands of rupees.

Sources: Saul Trejo, Industrialization and Employment Growth; Mexico 1960-65, p. 112 (PhD thesis, Yale University, 1971); Gustav Ranis, Industrial Efficiency and Economic Growth: A case study of Karachi, p. 33 (Karachi, Institute of Economic Development, 1961).

Thus, even if companies of all sizes paid the same interest rate and had equal access to imported equipment at the same price, such wage differentials provide presumptive evidence that larger firms devote more effort to economizing on labor than do smaller ones. However, equal access to loan finance and equipment are not good descriptions of reality. Typically, small firms finance their expansion from the saving of the entrepreneur or his relatives and close friends, a group likely to have limited resources. If borrowing outside of this primary group occurs, it is usually from non-bank lenders who charge two to four times the going rate charged by commercial banks. On the other hand, commercial banks and governmentally sponsored industrial development banks usually lend to the larger firms at relatively low interest rates. If interest rates of 10 or 12 percent are charged by these large institutions, smaller firms will typically pay 30 to 40 percent.

The pattern of wage and interest differentials must be assumed to play a major role in the pattern of increasing capital intensity by size of firm, as shown in Table 2 for Pakistan and Mexico. This pattern is also typical within industries, though inevitably some exceptions arise. The smallest companies exhibit very low capital-labor ratios, high average product per unit of capital, and usually a somewhat lower average product of labor. As size increases, the capital-labor ratio and output per worker increase and the output per unit of capital declines. Further analysis typically reveals that the smaller firms are at least as efficient as the larger ones in the sense that if both were to face the same socially relevant factor prices (i. e., the wage rate paid by small firms, and an interest rate which measures the rate of return in small scale industry), the average cost of production in smaller firms would be competitive with that of larger firms, indeed often lower.

While features of production other than differences in factor price ratios might explain some of the observed characteristics by firm size, most studies have concluded that they play a major role. Thus, the examination of capital-labor ratios by firm size provides a rich body of data which confirms the likely responsiveness of entrepreneurs to changes in their cost structure. Such studies have been executed for a sufficiently large number of diverse countries so that one may infer such responsiveness is a fairly universal phenomenon in Asia and Latin America, not limited to countries with a particular history or culture. It characterizes both large and small countries, those which are usually thought to be skill-rich and those which are not. In addition to the analysis of census and survey data, a substantial literature based on interviews confirms the strength of the small scale sector and the skilled entrepreneurship which characterizes many craft firms in LDCs. For example, in Pakistan the rate of return on fixed capital was over 18 percent for firms with 20-49 employees, and less than 12 percent for firms with over 100 employees.

However, it should be noted that neither the presence of abundant entrepreneurship nor many examples of efficient small-scale craft firms have been confirmed in sub-Saharan Africa. The 1972 ILO study of Kenya, despite its emphasis on the potential role of the "informal sector," offers little empirical evidence that craft firms with say 5 to 25 employees exist. Rather, the informal sector consists primarily of self-employed craftsmen such as tailors and carpenters producing products which cannot compete with typical industrial goods, in contrast to the craft firms found in Asia or Latin America. The absence of smaller firms and able entrepreneurs would seem to indicate the need for a different approach to obtaining labor intensive development, as the response to changes in factor prices may not be adequate.

Policy Advice to LDCs

The Need for LDC Government Agreement. The promotion of a labor intensive development process cannot go very far without the active cooperation of the central government. One might envision, for example, technical assistance on an individual basis from private advisers on small business and technology to a target group of companies in an LDC. However, no more than a few such aid recipients will be able to obtain an increasing share of investible funds unless current policies of artificially low interest rates combined with credit rationing by the banks are changed. While small businesses may exhibit high rates of return and could successfully compete for credit in a competitive capital market, their very smallness and paucity of collateral work against them in a rationed market. Similarly, the extensive use of import licenses in the allocation of both capital and intermediate goods works to their disadvantage as it necessitates substantial managerial time, to say nothing of cash payments, to obtain the requisite licenses. In another vein, unless wage-good output is increased and its price level thus kept low, the growth of nominal wages to both small and large firms will produce strong incentives to rely on increasingly capital intensive techniques. In sum, the requisite changes in the allocation of investment funds, import licenses, and the price of wage goods are beyond the influence of private, non-profit organizations or any other industrial extension agencies which work directly with LDC firms.

It is often argued that extension activities will generate a sufficient number of success stories that the demonstration effect will induce an unwilling government to pursue a labor intensive strategy, including a generalized liberalization of the credit and foreign exchange markets. Unfortunately it is unlikely to work. Although a small number of firms may, with intensive advice, identify new products, purchase appropriate equipment and undertake labor intensive low cost production, it is difficult to understand how this can occur on a sufficiently large scale without a prior change in government policies. Who will lend to large numbers of small enterprises at low (institutional) interest rates given the perceived risks, little collateral, and the disproportionately high administrative costs of small loans? Yet if the "demonstration from below" approach is to be persuasive it is necessary for it to occur simultaneously on a large scale in a number of industries and regions, and thus requires substantial amounts of investment funds.

More generally, this "private-non-government" approach is, in a fundamental sense, predicated on a shortage of entrepreneurs. Yet this assumption, for many countries, is counterfactual. The same studies which analyze the characteristics of firms of different sizes also show that large numbers of small firms (say with less than 50

employees) are present in many non-African LDCs in most branches of production, that they have made correct factor choices given the factor prices they face, and that they exhibit high rates of return on their invested capital. These are not the characteristics one would expect if the true bottleneck on expansion of firms using appropriate technology were the absence of entrepreneurial skills. Indeed, they are more suggestive of remarkably adaptive behavior in an economic environment which is skewed to favor large enterprises. There is little reason to doubt that had small businesses been able to obtain access to critical inputs, a faster industrial growth would already have occurred in many countries. My emphasis on the need to change the economic environment does not imply that technical services cannot be beneficial to LDCs, only that by themselves they are unlikely to exert sufficiently large quantitative effects to alter the course of an otherwise capital intensive development policy.

Governments must therefore be convinced of the value of making politically unpopular changes which could assist in the growth of industrial employment. But they may be unaware of the range of choices open to them in pursuing greater employment growth, and of the magnitude of the additional jobs which could be created. Their current policies are not necessarily a result of special interest pressures but rather a response to perceptions which are not accurate descriptions of the reality of their economies. Indeed, many of the most harmful government interventions, undertaken in most cases to effect import-substituting industrialization, were originally advocated by those most concerned with income distribution and unemployment. Important groups in both business and labor are now deriving considerable windfall benefits from the existing system. But there is also extensive evidence of the recognition by many governments of the need to alter current policies if violent change is to be avoided.

Given my premise that changes in technique require government-supported changes in factor prices, it is necessary to follow a two pronged strategy of advice: (1) where governments are insufficiently aware of the employment gains which will result from a change in policy, a demonstration is needed of the aggregate gains; (2) enhancement of the government's ability to achieve the employment goals.

Demonstration of gains from change in policy. An important contribution to generating LDC interest in the possibilities offered by labor intensive techniques can be made by: 1) A systematic cataloging of those economically efficient techniques by industry which have so far been established. This would include, for each process, specific production alternatives such as the type of core production equipment available, alternate peripheral processes, the sources and costs of relevant equipment. 2) Use of the above information in projecting a plan or set of growth objectives which an LDC government would find

plausible and desirable. Such a plan may be the official national plan document, but this is not necessary. Projections for an industry can be made of probable total employment growth without altering current production methods, and also with two or more alternative factor ratio regimes using more labor intensive techniques. The saving in capital obtained by producing the planned output in a less capital intensive manner should also be calculated, as this is a major benefit that is insufficiently emphasized in most analyses. The output of some projects which were not included in the original plan, but which now become feasible because of the freed investment resources, could also be calculated.

An illustration of this method is presented in Table 3 using data from a study on the choice of technique in textile weaving. Four methods of producing woven shirting material were identified, each exhibiting considerably different labor requirements and capital costs. Columns 1 and 2 indicate the inputs required to produce an additional 100 million

Table 3. Aggregate Effects of Alternate Weaving Techniques

Type of Loom	Requirements per 100 million square yards per annum		Capital/Labor Ratio (2)/(1)	Gains from using Lancashire Loom		
	(1) Man-years	(2) Investment	(3)	Investment Funds Saved (4)	Additional Employment[a] (5)	Increase In Output[a] (6)
Lancashire	2,180	$ 3,582,000	$ 1,645	- - -	- - -	- - -
Battery	1,110	7,163,500	6,454	$ 3,581,500	3,247	100%
Airjet	820	7,877,700	9,665	4,295,700	3,971	120%
Sulzer	510	15,006,300	29,715	11,424,300	8,615	319%

[a]Employment and output from the use of funds saved if these were invested in additional Lancashire looms, or in an activity with the same capital/labor and capital/output ratios.

Source: Underlying data were obtained from Cotton and Allied Textiles (Manchester, The Textile Council, 1969).

square yards of material, an increase well within the goals of some development plans. Column 3 indicates the capital-labor ratio associated with each type of process. Column 4 shows the amount of investible funds saved by adopting the Lancashire loom, the least capital intensive one, rather than each of the others. Column 5 indicates the additional employment which would be generated by investing the funds so saved in an activity whose capital-labor ratio was no greater than that of the Lancashire loom. Finally, column 6 presents the percentage increase in output which could be generated by investing the saved funds in ad-

ditional weaving capacity. Obviously, other possibilities will be open; the output gain calculated here simply provides some orders of magnitude. Table 4 indicates the overall costs of three of these alternatives under representative conditions.

The potential contribution of systematizing information on available techniques and analyzing their implication for a given LDC is obvious. Existing evidence on the benefits to be derived, industry by industry, assure that these are likely to be enormous and such calculations are likely, at the least, to stimulate governments to consider some of the policies necessary to realize them.

Table 4. Costs of Weaving Shirting Material with Three Methods (dollars per 100 yards)

	Lancashire Loom	Airjet (Elitex)	Sulzer Loom
Space	.198	.093	.152
Power	.385	.385	.291
Weft Waste	.035	.408	.338
Pirning	.472	-	-
Capital Costs[a]	.658	2.167	3.796
Cost of Labor (wage=$832 per year)	1.744	.652	.404
Average Unit Costs	3.493	3.705	4.981

[a]Depreciation and interest charges of 20 percent per annum; includes purchase price plus transport and installation costs equal to 20 percent of the cost of a battery loom.

Source: Cotton and Allied Textiles, Vol. II, p. 83 for lines 1-4. Line 6 calculated from pages 86-90.

Convincing the government of a country of the desirability of changing its economic policies to establish a climate more favorable to labor intensive development is necessary, but may not be sufficient to obtain such development. Although we know that firms of diverse sizes use different techniques, the speed with which changes to appropriate

production methods will be made may be accelerated by the presence of good advisory service, especially when there is a demonstrated absence of entrepreneurship.

Technical Assistance to Industry. The services of foreign advisers are likely to be best implemented by those who have been involved in industrial production management over a long period. These managers are likely to have seen the continuous evolution of production methods and are aware that the 1976 method differs considerably from 1956, to say nothing of 1936,and that the latter two were quite viable in their time. Labor intensive methods, particularly in the peripheral processes, characterized American and Western European production until well after World War II. A large pool of westerners exist who have been involved in relevant production management and who could convey both the physical feasibility of labor intensive production as well as some of the organization methods and innovations which surely occurred and increased productivity. By contrast, recent graduate engineers with little production experience are unlikely to be quite so open to alternate production possibilities. They have been exposed to the latest edition of a textbook in food processing and may be unaware that earlier editions showed different equipment. Moreover, most engineering texts and courses concentrate almost exclusively on the technical aspects of production, such as the chemical changes which occur, rather than on costs. Rarely are there discussions of the number of workers used by a machine or the relative costs of different types of equipment. Without exposure to the concepts of costs and the discipline of product prices, engineers are likely to be less open than those with similar training who have had production experience.

In addition to foreign technical assistance, governments should consider their potential for establishing an extension service for small industry within their own ministries, comparable to the advisory service commonly found in agriculture. The problems involved are more complex than those in agricultural extension, and there is less precedent and experience, but the activity merits further exploration.

Tax Policies. Most LDC governments levy some form of business profits tax. The wide variety of tax holidays and accelerated depreciation schemes are directed at reducing these taxes in the hope of generating greater investment, and many of these devices decrease the cost of using capital and thereby encourage capital intensive production methods and should thus be ended. Other ways of reducing the tax burden might be substituted which could encourage the search for labor intensive techniques. For example, reductions in the tax rate applicable to a given level of income could be made contingent on companies presenting a costing of alternate production processes when considering either replacement or expansion. Presentation of detailed cost estimates for at least one more labor intensive process could be made the standard for being placed in a preferred tax category.

Clearly, all firms could not be required to submit such proposals. Presumably, it would be best to start with the largest companies and then move down through the size distribution. An obvious and important potential role for foreign advice would be a catalogue of alternate processes as well as training for LDC administrators, facilitating their ability to establish the accuracy of the alternatives presented. Compliance with tax provisions could be aided by a national extension service, armed with pertinent information.

Strengthening Ability to Finance Loans. One other important policy area is to strengthen the ability of lending institutions to increase the access of small scale, labor intensive firms to capital. Clearly, not all loan applicants can be accomodated. Some screening must take place along with the high rates of interest which should discourage the less efficient firms from applying. Nevertheless, it would be useful to reconsider bank criteria for credit worthiness (possibly in conjunction with selective guarantees), and to make greater efforts to mobilize savings and time deposits. Higher interest rates would make an additional contribution to industrial growth by attracting more savings, as was shown in South Korea.

[Extracted from Attachment D to Proposal for a Program in Appropriate Technology. Submitted by the U. S. Agency for International Development to the U. S. Congress, June 30, 1976.]

Reorganization of Tool and Small Machine Production with Co-operatives in Sri Lanka

D. L. O. Mendis

[The government of Sri Lanka has been establishing a network of co-operative organizations to serve small and medium-sized producers of light engineering products. While encouraging the increase of small village producers using indigenous technology, the localized cooperatives help them to introduce step-by-step technological improvements. At the same time regional cooperatives perform similar services for enterprises using intermediate technology in provincial towns. Extension of similar organization to other industries is planned.]

Sri Lanka's 1972-1976 Five Year Plan presents the general framework for the country's economic development, with sector plans for agriculture and industry. The Industrial Sector Plan stresses the need for a self-reliant approach to development. It recognizes the existence of a traditional sector and a modern sector. In both sectors the development of an indigenous machine-building industry has for a long time been retarded by the unrestricted import of even the simplest types of equipment. Very high priority has now been given to the development of a dispersed small-scale light-engineering industry which will spread technological skills and productive employment in the rural areas. Implicit in this policy is a recognition of the value of an existing traditional technology which is basically an indigenous low-cost technology. This recognition is itself without precedent. A planned and vigorous pursuit of the progressive improvement of this indigenous technology will serve the objectives of rapid economic development.

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In both the public and the private sectors in Sri Lanka there already is a considerable investment in modern technology which is comparatively productive and capital-intensive. The progressive development of indigenous technology in the traditional sector has now been planned so as to gain from linkages with the high technology in the modern sector. This contrasts with earlier policies when new industrial technologies were introduced with little regard to existing low-cost producers whose development was thereby retarded. Examples of such mistakes include the introduction of modern power-looms which competed with existing handlooms, the development of mass-produced aluminum household goods which destroyed the traditional pottery industry, the setting-up of a State Hardware Corporation to manufacture various agricultural tools and implements and building materials which were already being made by indigenous industries, or the production of soap by the local subsidiary of a multinational corporation which almost eliminated the small-scale soap makers. Furthermore, all this modern equipment has represented a costly use of foreign exchange, a resource which has been in short supply in Sri Lanka for the past fifteen years.

The new approach is to establish cooperative organizations at two levels: at the local level, cooperatives serve the small producers using indigenous methods, and help to improve their skills and equipment; at the regional level, cooperatives serve medium-sized establishments with intermediate technology.

The Local Level: Dispersed Production Cooperatives

The chief vehicle for implementing the new development policy based on low-cost technology and the improvement of indigenous industrial capabilities was the Divisional Development Council (DDC). [The Division is a unit of local government.] The Council's projects are all in the form of cooperatives. One particular type is the Dispersed Production Cooperative. This is an organization of individual entrepreneurs and workers in a given industry in a particular region or Division. This type of organization has the following features.

1) Cooperative members continue to work in their village workshops. The individual worker may engage in productive work at any time of the day or night that suits him; he may be assisted by members of his family. The training of new workers takes place on a person-to-person basis in a comparatively small work-place.

2) The cooperative arranges for the supply of inputs and takes care of the marketing. Its members can devote most of their time to actual production, and they cannot be exploited by middlemen.

3) Financial assistance for an owner to improve his work-place, or for an employee to start his own business, is more readily available from the People's Bank through the cooperative organization than it would be for small independent individuals.

4) The individual owner has every incentive to develop his work-place and improve his technology and his productivity; and an employee has the prospect of setting up his own work-place one day with the technical and financial assistance of the cooperative.

5) Because of his membership in the cooperative, the individual producer can tide over market fluctuations more easily than if he were alone.

The Regional Level: Medium-Scale Industrial Cooperatives

Dispersed production cooperatives of village blacksmiths were first set up on the basis of one for each Division. By August 1974 more than 100 of these Light Engineering Industrial Cooperatives, as they are called, had been established in a total of 158 Divisions all over the island. At the next higher level of technology, cooperatives were set up for the owners and skilled workers of the small workshops which are very common in provincial towns. These are called Medium-Scale Industrial Cooperatives, and it was proposed to have such organization for each of the 22 administrative Districts in the island. Later it was decided to also have Medium-Scale Industrial Cooperatives in each of the Divisions in the Colombo District. By August 1974, seven of these Medium-Scale Industrial Cooperatives had been established. A Union of Light Engineering Industrial Cooperatives was also formed as the national apex organization for the light-engineering industry.

The Union, as the representative body of the organized light engineering industry in Sri Lanka, has broken into some new areas of activity, of which ship-breaking (for salvage of materials) is the most noteworthy. The Union has also purchased a modern production factory which manufactures motor and tractor spare parts, weighing machines and other products.

Through the organization of Light Engineering Industrial Cooperatives in the rural areas, the traditional low-cost technology of the village blacksmith has been made more productive, and the quality of production was improved. The cooperatives organized the supply of raw materials including scrap iron and steel, charcoal and small hand tools such as files. They also undertook the sale of finished products through a commercial center. Orders for various tools and implements were obtained in advance from government organizations as well as from the plantation sector, an important consumer of such hardware in Sri Lanka.

Quality Control. With the organization of supplies and wider markets for the village blacksmiths, a higher quality of product was required to meet market demands. Quality control is ensured by a combination of traditional and modern methods. Traditionally, the village blacksmith made and sold implements to the farmer on the basis of a person-to-person guarantee. This has been formalized in the cooperatives by giving each member an identification number that is stamped on every product, which is then guaranteed for one month from the date of purchase. If a defective item is brought back by the purchaser, the cooperative replaces it and returns the defective item to the maker. If the defect appears to merit special attention, the problem is referred to an outside consultant. This consultancy service is provided by metallurgists in the University's Faculty of Engineering and the Sri Lanka Institute of Scientific and Industrial Research.

The Pricing Mechanism. Since the blacksmith obtains his raw materials from the cooperative, he is liberated from the clutches of middlemen who had previously supplied the inputs and purchased his products, and generally retained an unconscionable profit. The producer now obtains much more of the profit. In order to give a fair deal to the consumer, a Price-Determining Committee has been set up in each cooperative. Usually this committee consists of three blacksmiths representing the producers and three local farmers representing the consumers, with an official of the Planning Ministry as the chairman. The committee examines the amount of raw materials and labor necessary for manufacturing the products on the basis of the blacksmith's low-cost technology, and arrives at the prime cost of production. A reasonable profit margin is allotted to the producer and a further mark-up of between 10 and 15 percent is allotted to the cooperative in setting the selling price to the consumer. Profits accumulated in the cooperative will in the future be used for the progressive development of technology.

Investment and Employment. With this type of organization, productivity has been considerably improved. Today a master blacksmith and two assistants can produce more than 2,000 rupees (about $250) worth of digging forks per month using the simple technology of the village smithy, which represents a total capital investment of some 5,000 rupees (about $630) at today's prices. New employment has been generated in two different ways. Firstly the master blacksmith takes on more helpers to increase his production. Secondly, skilled blacksmiths who are working as helpers are able to set up their own workplaces. The cooperative encourages this type of development with individual loans from the People's Bank. Some cooperatives have more than doubled their membership through this process in the last three years.

The Role of the Technical Centers

Once a Divisional cooperative has been established and has started to function steps have to be taken to set up a technical center. This center will be equipped with tools which are not generally available in the small work-places of the cooperative's members, such as a power hammer and power saw for reducing large scrap into the smaller billets which are issued to members. It will also include a lathe, a drilling machine, and both electric arc and gas welding equipment. This equipment will be used for certain specialized operations like the production of some component parts for small agricultural implements. An assembly unit will also be set up in the technical center to make small agricultural machines.

The progressive development of technology in individual work-places has been planned through the technical centers. At the village level a blacksmith is usually equipped with a hearth and a pair of bellows, an anvil, a number of sledge hammers, a vice, several pairs of tongs which he usually makes himself, a few files and sometimes a grinding wheel, and finally a manually-operated drill. With this equipment he can make a wide variety of tools and implements. In general he was dependent on traders for the supply of raw materials such as scrap iron, steel and fuel (usually charcoal). The trader also sold him the tools of his trade that needed periodic replacement like the files and the grinding wheels. Likewise the blacksmith was dependent upon middlemen for the sale of his products. As a result, he invariably functioned at a low economic level and did not have the capacity to generate sufficient savings to develop his technology.

With the organization of industrial cooperatives, the village blacksmith is now able to put aside a certain percentage of his earnings and invest it in the development of his technology. The progressive development of technology can be described as a step-by-step improvement of the tools of his trade. This improvement will in the first stage allow him to use the physical energy available to him in a more productive way. Thereafter, it will enable him to add mechanical energy to his production process. He will be able to pay for mechanical power with his own savings and with credit facilities made available through the cooperative. Next, using mechanical power, he will be able to manufacture products on a more systematic basis, and in larger quantities, and go into a production-line type of manufacturing if regular orders for his new products are forthcoming.

In practice, when a blacksmith produces more and increases his savings, he will probably have priorities other than the improvement of his technology. Settling old debts, improving his house, and purchasing movable property like furniture and jewellery generally take precedence over improvements in the work-place. But a few individuals will turn to investment, and the first blacksmith who takes steps to

improve his technology is a pioneer whose example is watched closely by the others before they decide to follow suit. The interest of the co-operative is therefore to encourage the success of this, and the consultancy service available through the technical center must be used to maximum effect at this stage.

The technology of the village smithy can be systematically improved in a number of ways: (a) by introducing a more efficient hand-operated blower to replace the bellows; (b) by the better conservation of heat in the hearth, and the use of waste heat for tempering and perhaps for annealing; (c) by introducing a mechanical finishing hammer (manually operated in the initial stage) to achieve a better finish in a more economical way; (d) by using grinding wheels to save on filing; (e) by introducing mechanical power which may be used initially for the mechanical finishing hammer, the blower, the grinding and finishing wheels and a drill; power may be used later to operate a simple lathe and a power hammer.

It is preferable to introduce mechanical power only when the blacksmith already has a certain amount of equipment, such as a mechanical finishing hammer, a blower, and a grinding and finishing wheel. At this stage, mechanization is an economic proposition. Mechanical power can also be used for other types of equipment, for instance, for the simple home-made hand-operated lathe which can be found in almost every smithy and which is used to turn out wooden handles for knives and other implements. It has been found that such a planned step-by-step development of technology is well within the bounds of reality once the productive capacity of the village craftsman has been liberated by the organization of cooperative, that is when the middleman has been eliminated and regular markets have been made available. At a later stage it is expected that the village blacksmith will be able to purchase and use more sophisticated equipment, including welding plant and machine shop plant. He will then have qualified for membership in the Medium-Scale Industrial Cooperative at the District level.

Innovation in the Medium Scale Industrial Cooperative

Medium Scale Industrial Cooperatives were set up to harness the un-utilized and under-utilized production capacities in workshops dispersed all over the island. These include small machine shops, repair garages and foundries. It has been possible to produce small machines such as two-wheeled tractors by farming out the manufacture of component parts to members of these organizations. This particular project has been tried out in no less than seven cooperatives which have all successfully manufactured and tested prototype two wheeled tractors (the engine, the chain and the main bearings of these machines are imported). This project was launched in the teeth of opposition from those who believe that the only way to make a two-wheeled tractor in

Sri Lanka is to set up a joint-venture with a foreign firm. The success of the project is therefore to be measured not merely in terms of the number of tractors manufactured in this way, but in terms of the number of individual entrepreneurs and skilled workers who have been given an opportunity to use their talents to create a commercially viable product. This is a very important element in achieving a self-reliant attitude to development.

At the beginning of this project the Ministry of Planning set up ad hoc committees of individuals who were known to be interested in it in order to launch the manufacture of this machine through the industrial cooperatives. This group of individuals brought in their varied expertise and gave the necessary initiative for developing the prototypes. This method has been quite successful. Prototypes have also been manufactured in public sector organizations under the direction of these ad hoc committees. It is expected that some of these public sector institutions will also undertake batch production of these machines in the future.

The first priority has been given to the development of the two-wheeled tractor, but the need for local manufacture of water pumps has been repeatedly emphasized by the members of several cooperatives. One such pump has been developed locally; it is mounted on the frame of the two-wheeled tractor and driven by the same power unit. Other machines which have been developed in small workshops as a result of the organization of the industrial cooperatives include a bicycle and a water pump. Both are now in batch production. Several prototypes of single cylinder air-cooled internal combustion engines have also been made but none of them have yet been taken up for batch production.

The reorganization of Sri Lanka's light engineering industry by the Ministry of Planning and Economic Affairs under the Divisional Development Council's program has met with such success that the same approach is being used for other industrial sectors. Steps are being taken to organize village potters who have been unfortunately discriminated against: bureaucratic ignorance has promoted other industries that tend to suppress the traditional pottery industry. Similar work in organizing the traditional textile industry can be expected in the future.

[Extracted from Appropriate Technology: Problems and Promises, pp. 206-12. Paris, France; Development Center, Organization for Economic Cooperation and Development, 1976.]

Entrepreneurship and the Promotion of New Low-Cost Technology

Nicolas Jequier

[In September, 1974, the OECD (Organization for Economic Cooperation and Development) sponsored a conference of some forty practitioners of the promotion of low-cost technology for developing countries, about equally divided between specialists from developing countries and those from Europe and North America. A major conclusion of participants, expressed in this synthesis of conference results, was that the individual entrepreneur has a vital and indispensable role in the promotion of new low-cost technology.]

> The work done by the various intermediate technology groups shows that it is technically possible to develop new products, production processes and services which are better adapted to the requirements of the people in the developing countries than those offered by the capital intensive high technology industries. Perhaps the most important contribution of these groups is to show that there are alternative approaches, and that the technical and human resources of the most underprivileged segments of the population can be mobilized much more effectively than they are now. Developing new technologies to meet what seems to be very real needs is however but one aspect of the innovation mechanism. Technology is a process, not an end in itself, and it must somehow be translated into new products and new services if it is to be of any use. Products must be manufactured and sold; and this can only be done by an industrial firm or, if the market is very small, by individual craftsmen.

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Individual entrepreneurs versus collective organizations

One of the most striking conclusions emerging from the September 1974 meeting was the strong emphasis placed on the role of the individual entrepreneur, and a generalized skepticism about the effectiveness of government agencies and cooperative organizations in promoting low-cost innovations. Another conclusion, stressed time and again, was that intermediate technology, if it is to succeed, must be economically, socially and technically competitive.

Stressing the role of the individual entrepreneur may appear like a return to old fashioned economics, and an implicit indictment of the organizational forms and ideologies which have increasingly governed the development effort of many countries in the last twenty years. On the other hand, it might be viewed simply as a reflection of the pragmatism and realism of the intermediate technology proponents. There is no doubt a certain cultural and social affinity between the philosophy of intermediate technology and the attitudes of the small entrepreneur, and this may account, at least in part and somewhat subconsciously, for the major emphasis given by many low-cost technology practitioners to the role of the individual entrepreneur. The economic and social life of a nation is immensely complex, and even the best policy-makers cannot hope to organize it in one single universal and rational way. What the various experiences presented at the conference do seem to suggest is that, as far as intermediate technology is concerned, some indications are available as to how not to proceed.

Among the many unsuitable approaches, the first to stand out is that of the cooperative movement. Many countries, for reasons which are essentially ideological and political, have tried to base at least part of their development effort on cooperatives, and in Tanzania for instance, this is today the main form of organization of the nation's economic and social life. The difficulties encountered by the cooperative movement in countries like India or Sri Lanka seem to be due to two types of reasons. The first is the high degree of administrative and technical skills required to operate such an organization. As far as administration and management is concerned, the cooperative network with all the services that must be coordinated is in fact a "high technology" enterprise, in the same way that the small family firm or workshop is a "low technology" organization. If all the members of the cooperative are to take an effective part in its activities, they need to have a relatively high educational level; and the central group of people who serve as its managers must be skilled administrators and, equally important, they need to be highly motivated.

The second problem touches upon the very ways in which cooperatives are formed. If we look at the cooperatives in Western countries which, judging from several decades of experience, have been the most suc-

cessful - for instance in the Scandinavian countries, in Switzerland or in Israel - one of the main reasons for success is that they were created by the people whom they benefit. At the origin of a successful cooperative, there is not only a community of people sharing the same values and interests, but also an institutional entrepreneur and social missionary. Yet despite the crucially important part played by such innovators, the success of a cooperative depends very much upon the involvement of the whole community.

The gradual building up of a cooperative network is a long process, and quite understandably, many developing countries have tried to accelerate the process by training administrative staff and establishing new cooperatives by government decree. These cooperatives, created by the government rather than by the communities they are intended to serve, are usually faced with tremendous administrative difficulties and, as a result of their political links with the government, tend to be viewed with great distrust by the population, especially in the rural areas. Large financial subsidies do not make them socially more acceptable. In fact, when they do have a lot of public money at their disposal, the members will almost inevitably interpret this as a private grant for their own personal use, or as a fair compensation for the exa ctions of the government tax collector.

This is not to say that cooperatives cannot work as a matter of principle. There are in fact examples of successful cooperatives in a number of developing countries, most prominently in agriculture. What the experiences of the practitioners in intermediate technology seem to suggest is that, in general, the cooperative form of organization is not the one best suited to the development and large scale diffusion of this type of industrial technology. For example, a very efficient small-scale means of producing crystal sugar was presented in India simultaneously to private entrepreneurs and farmer cooperatives created to use it. Four of the eight cooperative plants started between 1958 and 1962 ended in bankruptcy, despite much assistance; and only six more opened during 1962-74. By contrast, individuals had created 1200 new units in less than 14 years, and now produce almost 20 percent of India's crystal sugar.

The role of government

Large public or governmental organizations tend to be beset by bureaucratic inefficiencies and administrative weaknesses, and there are some justified doubts as to their ability to promote in a direct way the development of intermediate technology. Government agencies do nevertheless have a role to play - perhaps not as industrial entrepreneurs and innovators. But what happens is that the initiative of such people is often systematically stifled by the government bureaucracy, the banking and credit system, the marketing and distribution organizations, and last but not least the social pressures against innovation and change. The guarantees required by public credit institutions for instance are such that a new

entrepreneur has practically no chance of obtaining any financial aid. Import regulations and foreign exchange restrictions make it virtually impossible for him to obtain from abroad the equipment he needs either to manufacture goods or to develop his own technology; and when he does happen to have money, the priorities of the national economic plan do not allow him to invest it as he sees fit and he must spend vast amounts of time and energy trying to get approval for his projects. From the entrepreneur's point of view, it therefore makes much more sense not to engage in industrial activities and to devote his energies to socially less productive and personally more rewarding activities like trading or real estate.

One of the tragic paradoxes of this situation is that while governments on the one side are trying very hard, and often at great social and financial expense, to build up new consumer goods industries, the institutional obstacles to entrepreneurship on the other, coupled with the competition from these highly subsidized industries, is stifling the creation of new small firms and progressively destroying the economic and social bases of the local handicrafts industry. The example of the shoe manufacturing industry in one Middle Eastern country is unfortunately very typical: the new factory imported from Western Europe at great expense flooded the market with cheap plastic shoes and ruined thousands of small shoemakers who are now unemployed. Many developing countries are spending vast sums of money to import foreign technology, but at the same time these imports are helping to destroy the existing technological system in a large number of sectors. Clearly the process of creating and diffusing new technology is inseparable from the decay and disappearance of older technologies and obsolete knowledge, and a complete preservation of the past can only be achieved at the cost of complete stagnation. But in many countries this process of destruction of traditional technology is artificially accelerated by large-scale industrialization and, what is of much greater consequence in the long run, it is destroying both socially and morally the very class of people who have the technical and inventive ability which is so important in the process of development.

This is not to say that the actions of government are always harmful, or that large scale industrialization as such is an evil. But governments could do much more than they have by helping to create a more favorable climate for the development of entrepreneurship. Before even considering what positive measures might be taken, it would be useful to start by dismantling at least some of the institutional obstacles to entrepreneurship. These obstacles are innumerable, and in most cases relatively easy to identify: it is only necessary to ask those innovators who have succeeded in overcoming them. Such surveys have seldom been conducted; and if they were followed up by specific remedies, they would probably be much more useful and effective than the somewhat grandiose schemes for technical education, management training or information services established by government authorities, often on the ad-

vice and with the help of foreign aid agencies.

What such surveys would probably show is that the disincentives or obstacles to entrepreneurship are rather similar from one developing country to another. Among the most conspicuous, one could mention for instance the taxation system, which is often very favorable to large enterprises - including foreign firms - and overly harsh on the small company. Import regulations are another case in point. To give a typical example: in one of the large tropical African countries, a small entrepreneur had decided to start manufacturing aspirin. He had managed to buy the necessary machines and to import in bulk the raw materials he needed. But the refusal of the Ministry of Trade to reduce the enormous duties on small glass bottles, coupled with the duty free imports of aspirin in tubes from Germany, caused the new enterprise to close its doors and ruined the man who had started it . One may of course argue that he should have known about the structure of import duties and import regulations before starting. In this case however - and this is not untypical - regulations are constantly changing, and the entrepreneur cannot count on the minimum of stability which is required for building up new industries.

The social patterns of entrepreneurship

Creating a more favorable climate for entrepreneurship can be greatly facilitated by a number of relatively simple measures. There are however a number of social factors which cannot easily be changed. Among the most sensitive from a political point of view is the fact that certain types of entrepreneurship are often associated with certain ethnic and linguistic groups. In Cameroon for instance, some 80 percent of the trade in basic products like oil and soap is in the hands of the Bamileke. And in Kenya, the data show that 93 percent of new companies registered between 1946 and 1963 belonged either to European or Indian settlers, and that the total capital of the African owned companies amounted to less than 1 percent of these new firms. In Thailand, a large proportion of the entrepreneurs who have gone into the tractor rental business for the green revolution happen to be Chinese. In Zaire, the Balubas represent some 10 percent of the population, but reportedly some 70 percent of the university graduates belong to that ethnic group.

Hundreds of similar examples can be found elsewhere. It should however be stressed that the social tensions which arise from the ethnic or religious affiliations of a country's entrepreneurs are not specific to the developing nations: the history of the Jews in Europe or of the Protestant minorities in Catholic countries bears this out very clearly. The promotion of entrepreneurship, and in particular of entrepreneurship in intermediate technology, cannot leave out the cultural, ethnic and religious factors. One interesting way to deal with this problem is that of the INADES in the Ivory Coast. In that country most of the tradesmen are foreigners - Lebanese, European or Malian;

and the INADES has attempted through its training programs in the commercial field to build up a class of Ivorian merchants and shopkeepers.

If ethnic or religious affiliations are an important determinant in the patterns of entrepreneurship in a country, the same is also true of a society's system of values or its social traditions, and such things take time to change. That entrepreneurship is good for the economy is one thing, but its social acceptability is another. The motivations of the man who starts up a new enterprise are very complex, and he will tend to go into activities which are approved by the majority and which give him both financial rewards and social prestige. These activites are not necessarily those which contribute most to increasing the gross national product or to developing the country's industrial base. As P. D. Malgavkar has observed in his study of the techno-entrepreneurs of the Poona area in India, one of the most positive results of their work has been to bring about a gradual change in values and to make industrial activities socially more acceptable and more prestigious than they were a few years ago, and this in turn will probably motivate other industrial entrepreneurs to start up new firms.

The growing interest of many governments and aid-giving agencies in low-cost technology can contribute not only to its development and widespread diffusion but also, and this is in some ways more important, to giving the social and cultural prestige which it now lacks. There are clear indications that intermediate technology is now moving from a somewhat marginal position in development policy to a much more central role. This process of institutionalization means that more money will be available for new experiments. Needless to say, there are certain risks, and one of the main ones is that of bureaucratization. However one should not overlook the major social and psychological importance of this new trend. As long as governments and aid-giving agencies were concerned almost exclusively with large-scale projects and modern industries, it required an enormous amount of independence of mind on the part of the intermediate technology proponents and the few local entrepreneurs in the developing countries to stand up against what everyone else, including the experts, thought was right. Marginality is not of course a deterrent to the true missionary, quite the contrary; but in this case it meant that intermediate technology had little chance of involving the millions of people who form the silent majority, and who stand most to benefit from it. The active interest of national governments and foreign aid donors in low-cost technology could reverse this sitution by legitimizing the efforts of local entrepreneurs and innovators in this field, and by providing powerful incentives to those who might otherwise have gone into socially less productive activities.

Socially and politically, intermediate technology is not neutral. In fact, one of the basic assumptions of its proponents is that it should be

aimed primarily at the poorest segments of the population, most of whom live in the rural areas. How this can be done most effectively is not entirely clear. One of the means is to try gradually, through education, extension services, financial assistance and social rehabilitation to identify and stimulate the entrepreneurial and innovative forces which exist in all communities but which have been weakened and repressed by the existing economic and social system. What must not be overlooked however is the fact that these entrepreneurial forces, once released, will not focus exclusively on building up small industries and developing new technologies, but will also in many cases address themselves to social reforms and political change. The social background and the psychological dispositions which make a man a good potential entrepreneur are no guarantee that he will become an industrial entrepreneur and thereby contribute to increasing the gross national product. He may just as well become a political entrepreneur and a social revolutionary. This is not necessarily negative: it may in fact be one of the most effective means of stimulating a real development process in the most underprivileged segments of the population.

The competitiveness of low-cost technology

One of the most important factors in the diffusion of intermediate technology is its competitiveness compared to other technologies and other ways of doing things. A technology will not be adopted by the producers or the consumer because it is new - quite the contrary. Novelty as such is more often an obstacle than an incentive to its diffusion, especially in the rural areas. What is important is that it should be technically and economically more advantageous than both the existing traditional technologies and the modern technologies embodied in the products of large-scale industry. As several participants of the meeting have clearly pointed out, intermediate technology must be economically, socially and technically competitive with other types of technology, modern or traditional. It must also be commercially viable and capable of producing a surplus for those people who will be using it.

Two big difficulties arise here. The first is that the range of intermediate technologies which can be developed is considerably wider than the number of those which meet these basic conditions of competitiveness. One can wonder for instance whether the rainwater collection system presently being developed by the IRFED for African countries is really competitive. Their plastic sheets covering the traditional roof may well be technically appropriate, but one of the alternative solutions, namely the tin roof, is not only technically simpler but socially much more prestigious. The tin roof, quite apart from its practical convenience, is one of the most conspicuous signs of affluence and a top priority in a family's investments.

The second difficulty is that it is usually very delicate to evaluate the competitiveness of intermediate technology. Part of the problem

stems from the fact that the concept of "competitiveness" or "efficiency" covers three very different notions. The first is what might be called the technical or engineering efficiency of a new product or a new way of doing things. The second is its economic viability, and the third its social and cultural acceptability to those who must use it. On the basis of these three criteria, intermediate technology must then be compared with the traditional technologies and with the large-scale technologies of modern industry. This gives us six criteria of competitiveness which can be presented in the form of a simple matrix as follows:

Table 1. Criteria of competitiveness of appropriate technology

	Competitiveness vis-à-vis traditional technologies	Competitiveness vis-à-vis modern technologies
Engineering efficiency		
Economic viability		
Social acceptability		

In theory, the intermediate technology which stands the greatest chance of success on the market is the one which, on the basis of these criteria, happens to be the most competitive or the most efficient. In reality things are considerably more complex, and the successful innovator often has to rely more on his own experience and his personal hunches than on rational economic and technical analyses. This set of criteria does however suggest three important points. The first is that social or cultural acceptability is often a major factor in the success or failure of an innovation. Because it is so subjective and ill-defined, there is an obvious temptation to favor the more rational criteria of engineering efficiency or economic viability. The second point is that intermediate technology has to compete not only against the existing traditional technologies, but also against the whole technological system of modern industry. The latter is in many cases remarkably efficient, which suggests that intermediate technology is in a number of sectors totally inadequate.

The third point is the dynamic nature of the technological system. The criteria indicated here can give some idea of the competitiveness of intermediate technology today. As time goes by, however, they can change very substantially. What is socially acceptable today may no longer be so tomorrow. Modern technology is in a process of constant change, and even the basic economic assumptions (labor costs, price

of raw materials, import duties, transport costs) can be radically modified within a period of a few years. Many entrepreneurs sense this very clearly, and it is interesting to observe that in a number of cases their technological choices anticipate by a few years what is likely to happen in their country. Industrial wages for instance may be very low today, but most private entrepreneurs expect them to rise, and this, coupled with the development of trade-unionism, almost inevitably brings them to choose more capital intensive types of technology. This was the case for instance in the Bolivian cigarette industry, the Cameroonian soap industry, or the Zairian copper mines.

What the shifting nature of these criteria suggests is that appropriate technology, if it is to succeed, must not only be competitive today, economically, technically and culturally, with existing technologies: it must also have what might be called an evolutionary capacity. The problem in other terms is not simply to develop new technologies to meet an immediate need, but to build up an innovative capability, or innovation system. What international technology transfers can do is to introduce new ideas, new forms of knowledge and new ways of doing things. But what they cannot do is to help build up within the importing country the entrepreneurial and innovative basis which in the long run will ensure the widespread diffusion of low-cost technology. In fact, there are many indications that such transfers have the opposite effect, and contribute in some ways to killing off the innovative forces which exist. Almost all developing countries today are politically independent, and many of them are trying to gain a certain amount of economic independence. But what is the most difficult to achieve is a certain form of technological independence. Clearly, in the scientific and technological field no country can be completely independent, no more than it can be in the economic or the political field. Independence is a question of degree; but a certain form of technological self-determination is necessary in the development process. No country in history, not even Japan, has ever managed to develop exclusively on the basis of imported technology. This is the task of the indigenous entrepreneur.

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